THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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	Page
Institution of Mining Electrical Engineers	417
Electricity in Mining: A Cumberland Suggestion	418
British Manufacturers and Canada	418
Two Factors of 1909	419
The Problems of German Electrical Industry	419
Cinematographs and the New Regulations (*illus.*)	420
Correspondence :—	
Cinematograph Act (Electrical Provisions, Clause 12 C)	420
The Straight Tip	420
Contractor or Manufacturer?	421
Gas and Electric Mains	421
Picking up to a Fault in a Submarine Cable	421
The Development of Inventions	422
Protection and the Electrical Industry	422
English-made Cable	422
Publicity Literature	422
The Electrical Industry and a New Organisation ...	423
Legal	423
New Electrical Devices, Fittings and Plant (*illus.*)	425
Parliamentary	426
Business Notes	427
Notes	433
Extensions at the Burnley Electricity Works (*illus.*)	435
The Uses of Ozone (*illus.*)	437
National Electrical Manufacturers' Association	439
City Notes	442
Market Quotations	446
Stocks and Shares	446
Share List of Electrical Companies	447
Income-Tax in Relation to the Electrical Industry	449
Proceedings of Institutions :—	
The Ignition of Coal Dust by Electric Flashes (*illus.*) ...	450
Possible Uses of Waste-Gas Power...	451
Line Shaft Efficiency, Mechanical and Economic ...	453
Some Notes on Overhead L ne Construction	453
Physical Society of London...	454
Electric Transmission from Generating Stations worked by Blast-Furnace Gas	455
Foreign and Colonial Tariffs on Electrical Goods	455
New Patents Applied For, 1910	455
Published Specifications	456
Contractors' Column ... ... Advertisement pages 62 and 64	

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THE INSTITUTION OF MINING ELECTRICAL ENGINEERS.

IN our leader of December 11th, 1908, on "Electrical Accidents in Mines," we concluded with the following :

> There is one thing, however, which we venture to suggest might be done as a step towards what we believe is what every colliery engineer in the country would gladly welcome, and that is, for all mechanical and electrical engineers to form themselves into an "Association of Colliery Engineers," similar to the "Colliery Managers' Association," for their mutual benefit and protection, and quietly but firmly to agitate for their rights. As there must be many amongst our readers interested in this question, we will gladly throw our columns open to them so that they may state their views upon what we believe to be a most important and pressing question.

As a result of this paragraph, the recently formed "Institution of Mining Electrical Engineers" came into being, and at the first general meeting held in December last, the President, Mr. William Maurice, was good enough to acknowledge this fact. Consequently we have watched the development of the new Institution with a fatherly interest, but whilst we wish it every success in the work it has set out to accomplish, namely, that of furthering the application of electricity in mines, and minimising the risk of accidents; we very much regret that the first and most vital point, in our opinion one that for years we have been trying to impress upon the general public, and the mining community in particular, viz., to *raise the status and responsibility of the engineer to a degree at least equal to that of the underground manager*, has been absolutely ignored; and instead of the Institution being the means of improving the status of the mechanical or electrical engineer, it will do all that can be done to keep him where he is. For if we are correctly informed, very few engineers in charge of colliery plant have joined the Institution, the majority of the members being colliery managers and electrical manufacturers' representatives.

We have no wish to depreciate the work of the Institution; there is plenty of scope for its activities, but it ought to be ruled by the men actually in charge of the plant, and not by those whose duties are merely to give instructions as to what is to be done. Some colliery managers are so constituted that they cannot resist taking the credit of all good work carried out by those under them, while they are willing enough to disown responsibility when anything goes wrong. The manufacturers are dependent upon the colliery managers for orders, and, we are afraid that in some cases, so long as they get orders, it matters not to them who is to be responsible for the plant. In fact, a manufacturer's representative often prefers to have a man to deal with who is not fully conversant with the practice of electrical engineering, as he has a much better chance of creating the impression that his particular piece of apparatus is very much superior to

that of his competitors; this, of course, is more or less human nature, but it does not alter the fact that "all is not quite as it should be."

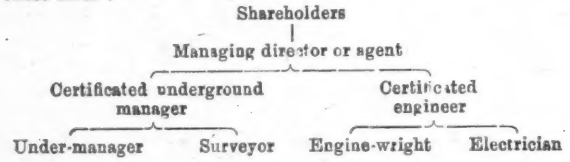
The Institution is at present inquiring into how and why electrical accidents occur, and how they can be prevented, and our attention is drawn to an article entitled "One Aspect of the Electricity in Mines Problem," by Mr. Douglas S. Martin in the current issue of the *Iron and Coal Trades Review*. In this article Mr. Martin says in relation to the latter question :—

> Coming at a time when compressed air for mining machinery seems to be gaining some of its lost ground, any effort which will give a fillip to the advance of electricity is to be welcomed. But I feel very strongly that the efforts of the Institution in their inquiry, and the resources of the manufacturers in their newest safety devices, will be largely unproductive labour if they fail to deal a blow at the system which is at the root of probably half the trouble. To achieve that end they will have to lay the whole case before the colliery managers, and use their weightiest evidence. Before anything else is done, it should be accepted as unquestionable that any colliery with generating plant of anything over, say, 300 KW., should be staffed by a competent and qualified electrical engineer-in-charge, with an assistant engineer, and at least four electricians. I know of some colliery managers who would not accept that programme very cordially to-day, but it will certainly come sooner or later. The *engineer-in-charge should be given absolute powers* over the generating station, the transmission line, the sub-stations, and all lighting and power connections.

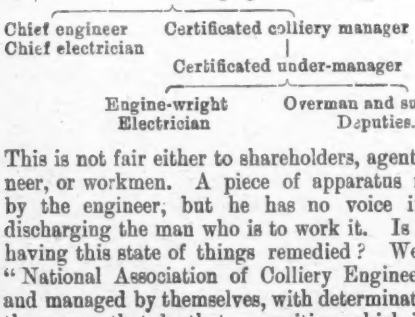
The italics are ours, and it is just this point we have been hammering at for years. Then follow several instances proving the necessity for the change advocated by Mr. Martin and by ourselves. We do not think, however, that the Institution as at present constituted will do anything towards raising the status of the engineer; in fact, the President has denounced the formation of any association for this purpose, as was suggested some little time ago in the correspondence columns of the *Colliery Guardian*.

No doubt some useful information will be gathered together in the course of the inquiry which is at present going on at the various branches of the Institution; and the manufacturers will be afforded an excellent opportunity for putting before colliery managers their various "fool-proof," "no-need-for-intelligence," "anybody-can-work-it" apparatus. It is noteworthy that, upon the introduction of compressed-air machinery, it was not found necessary to form an Institution of Mining Compressed-Air Engineers. Why? Because the machinery was more fully understood by the engineers-in-charge, the design and installation were left in the hands of the mechanical engineer, and as a rule the men working the machinery were under his superintendence. But even then, matters would be very much improved if the mechanical engineer were given absolute control and responsibility.

We do not desire a multiplicity of certificated officials at a colliery, but, in our opinion, the organisation should be on these lines :—



As things are at present we have—



This is not fair either to shareholders, agent, manager, engineer, or workmen. A piece of apparatus may be designed by the engineer, but he has no voice in appointing or discharging the man who is to work it. Is there no way of having this state of things remedied? We fear not until a "National Association of Colliery Engineers" be formed, and managed by themselves, with determination to have from the powers that be that recognition which is no more than their just due.

Electricity in Mining: A Cumberland Suggestion.

We are informed by a correspondent whose position enables him to write with knowledge that the Cumberland district has a good deal of prospective business calling for attention from the British electrical manufacturer. He does not claim it to be a newly discovered Klondike, or that gold will be won from the first turning of the sod, or that all our manufacturers' commercial representatives should catch the next train, hatching schemes *en route*, and then go tumbling over each other, simultaneously fraternising and cutting each others' prices. The plain facts, as we understand them, are these: There are large mining developments in hand, and others are projected, in the county, and mine officials are evincing considerable interest in electrical work. The newly formed Cumberland Branch of the Institution of Mining Electrical Engineers counts among its members more than 20 colliery managers and under-managers out of an initial membership of 36, and at the last meeting it was suggested by one of these colliery-manager members that it would be very advantageous at the present time if it were possible for members to inspect various mining electrical appliances. We have had several Mining Exhibitions in London at different times, but these do not meet the convenience of many men in far-off parts of the country, any more than the Manchester District Electrical Exhibition of the year before last met the needs of London or of towns up in Scotland. Furthermore, the Olympian and Agricultural Hall Mining Exhibitions have not been quite as electrical as is called for at the present moment. It seems to us that while visits of local sections to colliery and other installations in their neighbourhood are interesting and useful, they do not answer the same purpose as would a thoroughly representative exhibition of machinery and apparatus necessary for the manifold operations which can be filled by electricity in the modernly equipped mine. Such an exhibition should be supported by all the manufacturers who have anything worth showing, and it should be held at some place easily accessible to mine officials in Lancashire, Yorkshire, Northumberland, and Cumberland and Durham. It would not be a show intended to appeal to the public throng, as the electrical exhibition at Manchester did, and as that at Olympia in 1911 may be expected to do. It would be a technical exhibition for educating and enlightening colliery managers and other officials interested in the practical working of coal mines as to the equipments that manufacturers and inventors have placed at their disposal. Perhaps those among our readers who are interested in the matter will favour us with their views to guide our correspondent in any action that he may see fit to take. He fears it might be rather premature to ask the newly-constituted Provisional Committee on the electrical industry, alluded to in our last issue, to take the matter up. We fear so too, but we give publicity to his suggestion.

British Manufacturers and Canada.

When we have ventured to urge the British electrical manufacturer to give greater attention to Canada as a "dumping ground" for his product, there have been some who have curled their lip and continued on the even tenor of their way. Others have followed the wiser policy of energetic and thorough investigation in the old conviction of "nothing venture nothing have." If on complete investigation it be found that to manufacture over there is the only way to deal with certain classes of goods, then, as we have said before, let us put down our money and manufacture, instead of permitting everybody else to get there while we do nothing. We rejoice at the greater activity of some of our well-known firms whose close study of the market has already yielded important and guiding criticism regarding peculiarities that are creeping into Canadian municipal electrical contracts. From tenders for certain work reported upon elsewhere, we see that a Trafford Park firm was well in the running

against Canadian electrical manufacturers, though it did not actually carry off the contract. Lamp-makers are enterprisingly handling their own class of goods, and some of them are spreading their efforts very widely. This week, as we state on another page, there comes the news that a very active German company is beginning large lamp-selling operations there with the intention, if the demand is found to justify that course, of erecting a manufactory over there. British firms will do well to weigh this action, and see where they stand in relation to it. They will also do well to study some extracts that have been forwarded to us by an English correspondent, from a letter just to hand from Ontario. The writer says :—

Don't you think it is worth your while to consider manufacturing for this market—one which is going to be the greatest in the world in the coming years? Don't think I am "shooting hot air," as the Yankees say, in making the above statement; no one can spend any length of time in this country without realising that the progress made by the States in the nineteenth century is going to be equalled, if not surpassed, by Canada in the twentieth. So you can imagine how it riles a Britisher to see all the trade going to the States, because firms in the Old Country won't study the requirements here and make a determined effort to get hold of the trade. . . .

I do know this, that if I had the money to do it I would certainly spend a few months in the Old Country in an endeavour to get manufacturers to take up the question seriously. These I have mentioned are not the only lines, of course. In the whole range of electrical and gas supplies which I handle, I don't think there is a single article of British manufacture, and I cannot for the life of me see that there is any really good reason for this.

There was doubt expressed as to whether Dives's brethren would believe though one rose from the dead, and we are may express doubt whether manufacturers who are not inclined to take action after all that has been impressed upon them in our pages, are likely to take up the question seriously if this Ontario writer were to return from Canadian soil for the express purpose of persuading them. The correspondent who encloses these extracts adds : "Would it not be possible in the interests of electrical manufacturers to point out in your columns the urgent necessity of their being directly represented in Canada, in view of the rapid strides in that country"? The fact is, this same thing has been said by us again and again and manufacturers know it. Some of them are taking active steps, which in due time will issue successfully for the benefit of themselves and British industry and industrial investments. Let others go and do likewise.

Two Factors of 1909.

In the report of the British Insulated and Helsby Cables, Ltd., which we print elsewhere, there are two sentences which concisely summarise the past year's work and hopefully comment upon the present outlook. Some of us if we began to write upon the causes of unsatisfactory business in the electrical field might have difficulty in making an ending. Here we have the position as experienced by this particular company stated for us without either padding or fringe—a plain business fact :—

The volume of trade during the past year has been less than in 1908, especially in the manufacture of heavy cable, a result largely due to the increased use of metallic-filament lamps, and the falling off in the construction of electric tramways and other work.

It is, however, satisfactory to be able to say that the volume of business done so far this year is larger, and orders in hand at present compare favourably with the corresponding period last year.

If we were always so ready to go straight to the point when discussing reasons for unsatisfactory trade we might be on clearer ground. Of course the metal-filament lamp hindered several branches of electrical and steam engineering industry ; and, of course, when new tramways are not being put down and old ones are not being extended, works which have hitherto been largely engaged upon such manufactures, feel the effect, in some cases seriously. We believe that these two factors have been far more powerful in their influence upon the situation than many others that have been discussed. Continental countries have had to contend with both set-backs, though, having a larger scope, less internal "cutting," a larger amount of railway electrification, also the advantage of more generous financial backing, and not so serious a falling off in tramway construction as has occurred in these islands with their more limited area, their manufacturers have not suffered to the same extent.

The representative of a plant manufacturing company, in the course of conversation with us the other day, remarked that they recognised that the future would not bring them many more station plant contracts for home lighting and power systems, or at any rate, not the same number as used to be booked when every town was putting down its new station or extending. Alluding to a particular foreign market, he remarked that they were "looking to that as one of their dumping grounds for the future." The above statement that the business so far done in 1910, and the orders in hand at present, are more satisfactory than a year ago, is a further confirmation of a number of other testimonies to the same effect that have been forthcoming recently. The B.I. & H. ordinary dividend is again 10 per cent., but its carry forward is less. We hope that its 1910 results will bear evidence of as great prosperity as was experienced in 1908.

The Problems of German Electrical Industry.

A series of articles dealing with the problems of the electrical industry was recently published in the columns of a Berlin newspaper from the pen of Herr Emil Rathenau. The author states that as the first requirements in plant for lighting and transmission of power, the working of tramways and for chemical and metallurgical purposes have been more or less covered, the time is approaching when the worn out or antiquated types will have to be replaced by improved and more modern plant. The existing electricity works must pay attention to the further development of their installations if they are to maintain or even increase the profits hitherto prevailing, since the dominating tendency forces a reduction in prices, at least in the case of power supply stations ; a reverse tendency exists in the case of tramways. In his opinion, extensive districts should combine for the erection of large stations, which would supply the small localities at cheap rates. The utilisation of natural powers already prevails to a large extent ; where large quantities of energy are available attempts are made to utilise them. If this takes place without geographical limitation and distribution ruinous competition may result. Rights of way are necessary for the proper distribution of energy, and it should be the duty of the legislature to provide them. It remains to be seen what position the Government will assume in regard to the question of prices for supply, but it can probably be predicted that not only the interests of the State undertakings, especially the railways, but also those of other customers, will be kept in view in regard to the granting of a concession. These power stations, some of which will supply countries, others provinces, and still others smaller or larger districts, will arrange their prices according to the cost of production. After stating that the large works in Berlin annually lose a large amount of money by the continuance of existing conditions when one electrical horse-power would displace eight men and be very considerably cheaper, the author refers to heating, to the lighting of trains, which will rather be solved in connection with the conversion of the railways to electric traction, and to the working of railways by electricity. He foreshadows the erection of large works in association with coal mines and using inferior fuel, with waterworks and with works having waste gases at disposal, for the purpose of supplying cheap light and power. The direct current system will presumably continue for towns having a dense population, for chemical and metallurgical purposes, accumulator working, and for special processes, but the tramways will have to consider the problem of changing over to another system sooner or later, if they are to continue remunerative as they extend their network. The single-phase system, the author concludes, seems to have been accepted in principle for railway working except in the case of suburban and city railways, which will afford a large scope for direct current.

D

CINEMATOGRAPHS AND THE NEW REGULATIONS.

By "RESEARCH."

Now that every large hall is almost of necessity equipped for cinematograph displays, the Home Office has thought it desirable to issue special rules dealing with the electrical equipment of the same. These regulations, if properly carried out, will practically remove all danger to the public witnessing the display and ensure better working conditions for the operator's health and safety. They have attracted a good deal of attention, because compliance with these rules will necessitate at least some alteration to a vast number of cinematograph installations.

Clause 12 (*c*) states: "When the cinematograph lamp is working, the pressure of the current across the terminals of the double-pole switch inside the enclosure shall not exceed 110 volts."

Clause 12 (*d*), dealing with resistances, goes on to say: "All resistances, with the exception of a resistance for regulating purposes, shall be placed outside the enclosure, and if reasonably practicable, outside the auditorium."

Let us consider the difficulties in the working of a cinematograph arc from the standpoints of the operator and the supply authority. When the arc is first struck, a short time elapses before the splutterings and adjustments allow of the film being shown. For this period a small current of 10 or 20 amperes is just as effective as 40 or 50. It is more economical, therefore, for the managers of the hall, and avoids a rush of current on switching on with all resistances cold. That this rush of current is serious, and will often affect the voltage of the supply authority, the record on the adjoining chart will prove. This record was taken at a variety theatre having two performances nightly. The cinematograph was in use from 8.15 p.m. to 8.40 p.m., and from 10.10 p.m. to 10.35 p.m. All the resistances were some distance from the operating box, and consequently no adjustment of current was possible. The recording paper registers from 0 to 50 amperes, and the bad kick when switching on would make the lights jump in any small town. Therefore, we see it is highly desirable that the operator should be able to regulate the current from his operating box, and he will get the best results if he has several currents to work with.

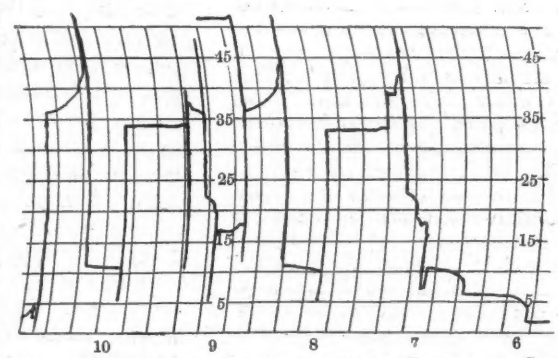


Fig. 1.—Chart of Cinematograph Load.

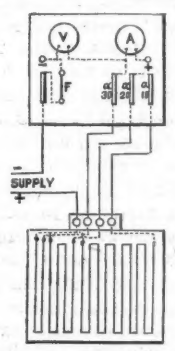


Fig. 2.—Diagram of Connections of Resistances.

If the regulating resistance is in the operating box, special precautions will have to be taken, and the resulting heat added to the heat of the arc and the confined space is far from healthy for the operator. It is, therefore, better to remove all resistance wire from the box, and this can be done whilst retaining the advantage of regulating the current by adopting the arrangement shown in fig. 2.

The switchboard is fixed in the operating box, and is fitted with two terminals + and − for attaching the arc leads to, and an ammeter A and voltmeter V if considered necessary. The fuse F will allow the operator to have the current off for the shortest time possible. The principal features of the board are the three knife switches marked 10, 20 and 30 amperes. These are connected by three wires to three resistances, which may be placed in the most fireproof place in the building. By closing one or more switches at a time, 10, 20, 30, 40, 50, or 60 amperes may be obtained. This arrangement has been found to work very satisfactorily in practice for a number of years. Four wires are necessary from the source of supply instead of two, but as only one of these will ever carry the maximum current, the other three may be much smaller.

Stoke-on-Trent.—The new municipal buildings, which are to be erected at a cost of £25,791, are to be lighted throughout by electricity.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Cinematograph Act (Electrical Provisions, Clause 12 C.).

"Cables for cinematograph to be taken as separate circuit from source of supply, and from supply side of main fuses in general lighting circuits."

I should be glad to know if any differences of opinion have arisen as to the interpretation of this Clause, whether it is held to be sufficient to run the cinematograph circuit back to the supply side of the consumer's double-pole switch and fuses, or if it is required to run the cinematograph circuit right back to the supply side of the service cut-out. In the latter case it would be necessary to provide an additional way on the service cut-out and an additional meter. Apparently the requirements of the Act would be met by the former arrangement, provided that the combined capacities of the fuses in the cinematograph circuit and in the general lighting circuit were less than the capacity of the fuse in the supply service cut-out, the object of the regulation presumably being to avoid the extinction of the general lighting as a result of a short circuit on the cinematograph circuit.

J. W.

The Straight Tip.

We trust that "the straight tip" given by Mr. Arthur Shaw in the Review of February 25th will not be taken too seriously by any contractor, to the extent of imagining that Ilford is a happy haven for contractors, as his statement as to "our local contractors having benefited by the showroom" is, to a great extent, beside the mark, as also is his statement that "the little feeling against it" has died out. Instead of this, feeling against it, if anything, runs decidedly higher amongst the majority of contractors. Mr. Shaw's statement that one contractor is "next door" is what one might term a "terminological inexactitude," as the relationship is much closer than this. In fact, the contractor in question is fortunate enough to be on the same premises as the Council showroom, divided only by a matchboard partition. There is a door leading from the showroom to the contractor's portion, and the telephone installed in the contractor's office is the one used for all communications to and from the Council premises. The whole of the premises, with the exception of the actual showroom and window, is leased by the Council to the contractor.

What is the result? The average lay person naturally looks upon the fortunate tradesman as being the "official" contractor from the fact that he is under their wing, and, consequently, other contractors are placed at a disadvantage from the start. True, a board is displayed at the rear of the showroom giving the names and addresses of all the contractors (for which they are privileged to pay the sum of 12s. 6d. per quarter each), but is it likely that any "lay" person wishing to purchase lamps, or any article shown in the showroom, would go round to the addresses shown, when he can obtain them on the premises?

No, Mr. Shaw, you are far wrong when you state that the

local contractors have benefited by the system named. We do not blame your tenant for taking full advantage of the benefits accruing, but we do say that any contractor placed in this position has an unfair advantage over the others. By all means keep open the showroom, but for the sake of equity, lease the portion of the premises not required by yourself to someone unconnected with contracting, and let each contractor's success depend upon his own ability and "pushfulness," giving all an equal chance for such contracts and inquiries as may come to the works.

In the event of the desired Mecca of free wiring becoming an accomplished fact, it should not be difficult to arrange either to divide this work up at an agreed price, or to place it out to universal competition, at the same time taking measures to see that the work is up to the required standard, and showing favour to no one. In this way, a more amicable understanding between Council and contractors will be attained, to their mutual advantage, at the same time removing the feeling that undoubtedly still exists.

Three Ilford Contractors.

Contractor or Manufacturer?

Brighton.—A qualified firm of contractors agrees with the Electric Supply Committee to carry out at its own (the said firm's) expense what appears to be an excellent scheme of free wiring. The Council throws it out on the representation of the "other" contractors who have neither the pluck nor the financial ability to embark on such a scheme.

Result.—The Committee *don't* get their increased output, the ratepayers *don't* get the advantage of electric light, the contractors *don't* get the wiring jobs, and the manufacturers *don't* get the sale of materials.

Croydon.—Two or three energetic contractors apparently get all the business in the town because they *are* energetic—the rest growl and put it down to favouritism, bribery, supply authority's showrooms, &c.

By the way, can an electrical contractor *live* in a town where the supply of electricity is in the hands of a company controlled by the British Electrical Federation? And does not the latter control *Electrical Industries*, the doughty champion of the down-trodden contractor?

(nearly) "'Nuff said."

Gas and Electric Mains.

Referring to your correspondent's letter in this week's Electrical Review concerning the difficulties arising from gas accumulations in electric mains conduits, it may interest your readers to hear of a low-priced and reliable apparatus recently invented to detect the presence of coal gas in any proportion from ·5 per cent. to 50 per cent. By its use the condition of the conduit could be ascertained at sight whenever required without the slightest fire risk. The apparatus is being sold to gas consumers for house testing, to enable them to see leaks in their gas fittings, the risks they run, and the general desirability of electric light and power.

I shall be happy to give further particulars to interested parties.

Fred. J. Turquand.

London, W., *March 10th*, 1910.

Picking Up to a Fault in a Submarine Cable.

In connection with some other work, I was reminded the other day of a method which suggested itself to me some time back for detecting, when picking up to a fault on board a cable ship, when the latter is inboard.

I have never seen this method described, and it is so simple and practical that I have some scruples in bringing it forward, seeing that I have given the method practically no trial myself. On the other hand, I realise what great saving would often ensue during cable repairs, in useless cutting up and expenditure of good cable, should a satisfactory method be devised of detecting, with certainty, when the fault is inboard. As far as I am aware, no really satisfactory system has, as yet, been published, and I have, therefore, decided to make public this suggestion on the chance of its proving useful, incomplete though the research on it has been.

The method relies for its success on the sheathing of the cable being picked up into the tank not being in perfect electrical contact with the earth. Allowing that this is the case, it can be seen that if a definite fall of potential can be obtained along the sheathing wire until the cable enters the water, a sensitive galvanometer connected to the core of the cable being picked up and to the framework of the ship for "earth," will be deflected by this sheathing current when the fault is inboard, and the amount of the deflection will roughly vary directly as the amount of cable picked up beyond the fault.

The suggested method of procedure is as follows:—Two good connections are made on to the sheathing wires, one connection lower down on the cable being picked up than the other.

Through the connection nearest the end of the cable being picked up is passed a heavy current, depending on circumstances, but varying between 5 and 20 amperes; this could be supplied through suitable resistances from the ship's lighting circuit or accumulators. No fear need be felt of damaging, by shock, the workmen in the tank, as the fall of potential along the sheathing wire to earth will in any case be low. The second wire joined on to the sheathing would be used for testing the maximum sensibility attainable; this is done by connecting this sheathing wire on to the galvanometer, the other side of the galvanometer being earthed on to the ship's hull. The heavy current passing into the sheathing should be adjusted until a deflection of at least 300 divisions is obtained, and then the galvanometer is connected directly on to the core of the cable being picked up, its other terminal remaining earthed, and the distant end of the cable being freed. An earth current from the cable should be opposed by a high-resistance shunt with a local E.M.F. across the galvanometer coils in the ordinary way, so as to keep the galvanometer at maximum sensitiveness.

The sheathing current should then be applied at intervals and reversed (the short-circuit key of course being closed for the K R time), and if this application is found to definitely alter the deflection due to the earth current in the cable, it can safely be inferred that the fault is inboard.

As can be seen from the above, the method depends solely for its success upon the possibility of obtaining sufficient fall of potential along the sheathing wire to earth and it can further be seen that the fault acts as a potentiometer connection, and thus its resistance only alters the sensibility of the arrangement. The writer is of the opinion that by the application of these heavy currents to the sheathing wires sufficient fall of potential will, in the majority of cases, be obtained. To give the test as much chance as possible, it would be advisable when possible to cover the bottom of the tank with tarpaulin, and vertical battens placed around the sides of the tank, a foot or so apart, would prevent the cable making good metallic contact with the tank's sides. If a long length is being picked up, it would be advisable from time to time to shift the point of application of the current to the top flake in the tank.

It would be advisable to "earth" the heavy current on a distinctly separate "earth" from that used for the galvanometer, and perhaps it will be preferable, to avoid false results, to earth this current on a plate hung over the ship's side, slight resistance in this earth being immaterial.

As the heavy current is only applied for very short intervals of time, there need be no fear of heating the cable detrimentally.

By the use of the test wire as described, it should be possible to tell before the fault is on board whether the method will prove satisfactory or not.

To give an idea of the order of the effects dealt with, allowing that the average joint resistance between the cable sheathing and the sea is as low as ·002ω, which is very unlikely; with 20 amperes flowing we should then get a fall of potential between the end of the cable and the sea of 4 millivolts, which could be easily detected with the ship's galvanometer.

If the test should prove unsatisfactory with these particular connections, the heavy current might be applied to the sheathing wires by means of a wheel just before it enters the hold, and the maximum potential would then be obtained immediately the fault was inboard.

I should be very interested to hear of any practical trials made with this method.

E. S. Heurtley.

Montreal, *February 28th*, 1910.

The Development of Inventions.

Mr. Horsnaill's article on the development of inventions, in your issue of March 4th, is very interesting. Idea-development firms are springing up, but evidently they are so little advertised that the supply and demand, though contemporary, are not yet thoroughly mutual.

No doubt there are many people who, like Mr. Horsnaill, participate in the demand, but are unaware that the movement towards meeting it has already set in. There is an illuminated sign in Aldersgate Street, just above the entrance to Cherry Tree Court, which announces that the Clarence Engineering Co., *Ltd.*—it has already got so far as that—is in business for the purpose which Mr. Horsnaill has in mind. No doubt there are other firms, too, but probably a small limited liability company, controlled by fairly-established people, and managed by someone who has lived through the sweets and bitters of invention, best fulfills Mr. Horsnaill's ideal.

H. W. Brady.

London, S.E.

Protection and the Electrical Industry.

I do not consider it "sporting" to let "Ex-communicated" bet £10 that his statement was "substantially correct," even if the bet is to go to a charity. His exact statement was in your issue of January 28th :—"At the present time, I export to all foreign countries, and I am forced to pay the duties on my goods, or make an equivalent reduction in price to my customers in these countries."

Even if we allow that "all foreign countries" does not include the U.S.A., where he admits the tariff is 45 per cent. *ad valorem* on electric motors, and accept his statement that the duties on his particular goods are about 4 per cent. in Germany, about 8 per cent. in Russia, and about 10 per cent. in France, we cannot reconcile the payment of 10 per cent. in France, with his assurance that his net profits are "not abnormal." Further, I showed that the duty in Russia was four times as much as he imagined. I may add that one good make of British 100-H.P. motor works out about £30 per ton ; so the case I cited, at £45 per ton, was a perfectly fair instance.

Replying to Mr. Rendell's courteous arguments, nations do not trade at all, but individuals do. Increased national production, therefore, does not necessarily lessen the cost of production at all.

Specialised production on a large scale by individual factories is, therefore, quite as feasible in small countries like Belgium or Switzerland, as in large countries like Germany and Russia. The economy of large scale production is almost entirely by reducing employment per article produced, by substituting automatic machinery for skilled labour.

German merchants do not refuse to import British electrical goods, or to pay the German import duty on them, whenever the price permits ; in the cases discussed the duty is only about 5 per cent. ; but Belgium, Switzerland, Italy and Austria have a considerable advantage over us in direct rail transport to Germany, involving less packing and lower freight. In practice, a tariff is merely an item of cost to the buyer, exactly as packing and freight are.

I agree with Mr. Rendell that Tariff Reformers and Free Traders alike desire universal free markets ; the difference is that Free Traders believe that half a loaf is better than no bread ; we prefer to keep all the freedom we possess, whether we can increase it or not.

If, as Mr. Elder claims, "voluntary Protection is universally approved," there could be no reason for agitation for compulsory Protection. It is quite true that, when it is a question of spending rates and taxes, a higher price may be paid than necessary, on the plea of keeping the work in this country ; and in municipal contracts, exactly the same plea is made for keeping the work in the individual town. But the very men who will do this in their political or vote-catching capacity, ignore "voluntary Protection" in their own businesses ; they will then only give preference to the home or local article on absolutely even terms.

The Free Trade case is that the high purchasing power in our free market enables us to compete on even terms both at home and in neutral markets ; and that it is to the interest of this country to prevent political interference with freedom of exchange of goods and services.

C. E.

March 12th, 1910.

English-made Cable.

We notice in your issue of the 11th inst., that the Hammersmith B.C. have accepted our tender for cable "subject to a guarantee that the cable is English made." We consider this qualification might give a wrong impression, and we, therefore, take this opportunity of stating that all our cables are manufactured at our works in Liverpool.

Liverpool Electric Cable Co., Ltd.

S. Hartford, *Secretary.*

Liverpool, *March 11th*, 1910.

Publicity Literature.

Our attention has been drawn to a letter in your last week's issue criticising the above. We are not, of course, interested in the writer's various views expressed, except on one point :—This is in regard to the prices mentioned as quoted by our clients, the Joint Publicity Committee. On this point the writer is entirely in error (the writer has, indeed, not even seen the actual poster or showcard, which he thus freely criticises). It would be impossible for any firm to make the unconditional offer to straightway supply a similar five-colour poster to an original design, or a circular similar to the one issued on the terms quoted by the Joint Committee. It is entirely due to the exceptional position of the Joint Publicity Committee that they can thus offer such extremely favourable terms. We regret that such irresponsible statements should be put forward even in an anonymous letter.

W. H. Smith and Sons' Advertising Agency.

The Electrical Industry and a New Organisation.

Again there appears to be a suggestion from those professing to be interested in the electrical industry, to form themselves into a Committee to take steps, &c., *vide* your columns last week, and it would appear, therefore, well to look into this matter before supporting it.

It would certainly be interesting to hear from the secretary of this new scheme—he happens to be the same as for the Electrical League formed some two years ago—what happened to that loudly-advertised and much-talked-of suggestion. It is nearly two years since subscriptions were asked for, and yet nothing has been done to help the industry, nor yet has any balance-sheet been published or sent to the members.

Might it not be as well for all interested in the industry to ask what has become of the subscriptions collected, and what steps were taken by the promoters of the League ? Again, they happen to be the same as those forming the new scheme.

Perhaps the hon. sec. will favour members with some results and other particulars as to what has been done in the interests of the subscribers, not the Committee. If this scheme, a revival of the League, is to be supported, let us first hear of the results of the previous endeavours.

It is well to ask for subscriptions, but it is work that is wanted ; and if no success came of the League, what will happen to this ?

I do not think the League is wanted, and the opinion of others would be interesting.

Once Bitten, Twice Shy.

I read Mr. Garcke's long letter to the Institution, which appeared in your columns a few weeks ago, and in which there was an abundant permeation of common-place platitudes and vague generalities, as well as his inevitable vein of antagonism towards municipalities which have had the temerity to enter the electrical field. I read the final (up to the present) reply of the Institution to Mr. Garcke, and I also read his acknowledgment, which seemed to me to convey the impression that he had been "Stung to the quick." Some might have thought that the letter which he received from the Institution would have been sufficient; but I should have been somewhat upset in my elementary calculations if the acknowledgment in question had been the grand finale of his efforts in the matter, and I have been waiting to see what developments, if any, would take place before penning these lines. I, therefore, was not in the least surprised to note the copy of communication in your issue of the 11th inst. Let me say at once, without any ill-feeling towards Mr. Garcke, that we do not recognise him as "a" or "the" leader of industry, and that we do not require any of his fancy organisations. Perhaps he may urge that it is for the benefit of the electrical industry, as ostensibly he intends the organisation to be, which he is endeavouring to create. Was the British Electric Traction Co. intended for the benefit of the industry? In this country we have had too much of it, and if Mr. Garcke will confine himself to his own flotations, and his very own, the B.E.T., he will find sufficient to do therein for the remainder of his natural.

One Who Knows Him.

LEGAL.

THE Z ELECTRIC LAMP MANUFACTURING CO., LTD., *v.* MARPLES, LEACH & CO., LTD.

(*Continued from page* 299.)

MR. W. L. PAKENHAM, examined by MR. WALTER, said he was the general manager of the Z Electric Manufacturing Co., the plaintiffs. The filament works were at Willesden, and the lamp works were at Wimbledon. The lamps which they manufactured were made with tungsten, which, in the majority of lamps, were mixed with a binding material, ground and squirted into filaments and put into the lamps, and it was their practice to paint the stems of the lamps with phospham. On the thicker filament of the large candle-power lamps they mixed the phospham with the paste before squirting the filaments. They adopted the first of the processes described in the specification. That process was used for all filaments larger than ·75 mm. in diameter. It was a distinct advantage to use the first part of the process, because it enabled them to make higher candle-power lamps, which they could not do before. As the result of using phospham at their works the number of lamps which blackened was under 1 per cent.

MR. TERRELL said he would call his evidence for the defendants before addressing his Lordship.

DR. OTTO HEHNER, examined, said he had examined the plaintiffs' specification, and had gone through the whole of the literature. He did not understand the specification as being one to prevent the blackening of lamps. He had not the faintest hint that the patentee stated, "I remove blackening," or that he meant to say, "I mean to use ammonia." What he said clearly to him was, "I want to do it by means of nitrogen and other gases given off by phospham." Witness then stated at great length the result of his experiments at Bergmann's factory in Berlin. He said he had ascertained that the blackening was due to tungsten, and not to carbon. To prevent a lamp from blackening it was necessary in the first instance to make the lamp as vacuous as possible, and get rid of the oxygen and all the gas as far as practicable. Silica worked quite as well as phospham. Phosphorus was the backbone of the manufacture of the lamp.

Cross-examined by MR. WALTER: He knew that phospham did give off gas continuously, as long as it came in contact with moisture or air that was moist. Phospham at 150° would react with moisture, and be decomposed into a substance which easily furnished ammonia. He was told in Berlin that the Bergmann Co. were the licensees under the German patent for the use of phospham.

MR. EDWARD BEVAN generally corroborated the evidence of the last witness.

DR. H. BRESLER, chemist in the Bergmann lamp factory, examined, said that he had examined the filaments after they had been bathed, and found the amount of carbon as between ·7 and ·85. To prevent lamps blackening, they adopted at their Paris factory, working without phospham, and exhausted the lamps with red phosphorus, only painting it on the stem of the lamp. One could not get good lamps with phospham only.

MR. F. P. MANFRONI, works manager at the Bergmann's factory, and DR. JOHANNES SCHILLING, Doctor of Philosophy, of Heidelberg, also gave evidence on behalf of the defendants. In summing up the case for the defence, MR. TERRELL said that this was a case where it was sought to put an interpretation upon the patent by altering to an extent that had never before been attempted. The specification was addressed to the expert lamp maker and not the chemist, and he was supposed to be familiar with the difficulties of lamp making. The lamp-maker would know that brittleness interfered with the serviceableness of the filaments, and it had long been suspected that the illness of these metal-filament lamps had been due to impurities, and he would probably suspect or think that the impurity was carbon; he would probably think that the blackening also was done by carbon. But, though it was well known that the greatest disease these lamps suffered from was blackening, there was not one word in the specification about curing blackening. The whole specification pointed to improving the strength of the filament. It was impossible to think that this man had in view the curing of blackening. The whole specification was governed by the first sentence, which said that the object of the patent was to remove carbon. The plaintiffs failed to prove infringement unless they could show that the defendants had used phospham to remove carbon. That being so, they had utterly failed to show that the defendants had infringed.

MR. WALTER, replying on the whole case, said the patent was not a chemical patent; the specification was directed solely to improvements in the manufacture of filaments. The patent was for the decarbonisation of the filaments by the use of phospham or some other compound of phosphorus, and the rest was merely means of carrying out the process.

At the conclusion of the arguments his Lordship reserved judgment.

JUDGMENT.

On Wednesday, March 9th, MR. JUSTICE PARKER delivered judgment. His Lordship said the Letters Patent alleged to have been infringed in this case were No. 21,654 of 1906 for "Improvements in the manufacture of filaments for incandescence electric lamps." The complete specification commenced by stating "In the manufacture of incandescence electric lamp filaments from metallic compounds, it is desirable to obtain the finished filaments as free from carbon as possible, because if even a small amount of carbon be contained in filaments it interferes very prejudicially with the strength and serviceableness thereof." On the evidence it appeared to him that this statement was correct. *Ceteris paribus*, the existence of carbon in a metal filament undoubtedly tended to weaken it, so that it was brittle and broke easily if roughly handled, and also to shorten its life, though there might be circumstances under which a certain amount of carbon in the filament was comparatively innocuous. It was considered, too, at the date of the Letters Patent, that carbon in the filament was the cause of the lamp blackening. As to that there was some controversy. It was now known that it was a metal and not (as in the case of carbon filaments) a carbon deposit which blackened the glass of the lamp, but, nevertheless, the better opinion seemed to be that carbon in the filament did in some way, imperfectly apprehended, conduce to this blackening. Having regard to the prevalent belief that blackening was due to carbon, he thought the inference was that one of the advantages which the patentee contemplated would result from removing the carbon, was that the lamp would not blacken, though this was nowhere expressly mentioned. The specification next referred to some proposal, which was not identified in the evidence, to employ nitrogen for removing the carbon, and the difficulty of doing so on a commercial scale, because the means employed for that purpose generally injured the metal of which the filament was formed. The present invention, it said, provided means which could be carried out on a manufacturing scale, by which the last traces of carbon in the filament were removed in such a way that the metal did not suffer. The specification then stated what the invention was. It was said to consist in effecting the decarbonisation of the filaments by means of gases produced in vacuo by heating phosphorus compounds containing hydrogen and nitrogen, and also optionally containing oxygen or sulphur, such, for example, as phospham, phosphoramide, and other specific substances with the addition of phosphorus if necessary. Phospham was said to be specially suited for the purpose, because not only was the nitrogen contained therein released in vacuo from its combination, even at a comparatively low temperature, and when set free formed with the carbon, cyanogen or cyanogen compounds, but likewise the phosphorus which was at the same time set free was capable of fixing the oxygen still present or exerting its reducing action upon metallic oxide, should it be in the filament, and some red phosphorus might (it was said) also be added, especially in cases where oxide might be present in the filaments in appreciable quantities. It appeared from this that the function of the nitrogen was to remove the carbon, and the function of the phosphorus was to remove any oxygen and reduce any metallic oxide. It was not stated in the specification whether the hydrogen which was spoken of as a necessary ingredient in any phosphorus compound to be employed, had any function at all. The inventor then proceeded to give examples of the way in which phospham could be employed. First a little phospham was added to the metallic powder, and the mixture was ground thoroughly and a paste prepared in the usual way. The amount of phospham to be used depended on the binding agent employed in making the paste. The filaments were then in the ordinary course squirted and raised to incandescence by baking *in vacuo*. The action of the phospham took place directly in the filaments during this baking process; they became absolutely free from carbon

without their strength being injuriously affected. Secondly, the phospham, instead of being mixed in the paste, might be placed with the squirted filaments in the baking oven, so that the gases therefrom might act externally on the filaments during the baking process. In this case they took care to secure as complete a vacuum as possible. The vacuum pump was kept on till the furnace reached a heat of about 130° C., in order to remove the water and decomposition products to that point. The cocks were then closed and the furnace slowly heated to from 800° to 1,000° C. The phospham was thus decomposed, the gases produced being under a pressure of a column of mercury of a few millimetres. It was said that this pressure depended on the amount of phospham used, and that the amount to be used depended on the amount of carbon in the filaments, the baking process being prolonged if the filaments contained much carbon. The filaments treated in this manner were, he said, also completely free from carbon and solid impurities. In the third and fourth examples, the phospham acted on the filaments in the glass bulb, in which the baked filaments were sintered or flashed, and in the fifth and sixth examples in the globe of the lamp itself. In all these cases the gases released by heating the phospham were said to act on the filaments and to remove carbon therefrom. The specification concluded by stating that in the place of using solid phosphorus compounds the gas mixtures corresponding to the decomposition products resulting from the heating *in vacuo* of the said phosphorus compounds, could be employed. He did not understand this as giving yet another example of how phospham could be used, but merely as showing that the patentee considered his invention broad enough to cover the particular procedure suggested. By the first claiming clause the patentee claimed:—"In the manufacture of incandescence electric lamp filaments free from carbon, the employment of phospham, or equivalent phosphorus-hydrogen-nitrogen compound, or an oxygen or sulphur compound thereof; either in the production of the raw filaments, or by causing its decomposition products obtained by heating *in vacuo*, to act on the raw filaments." The second claiming clause claimed a particular method of baking the filament when phospham or its equivalent compound was so employed. By the third claiming clause the patentee claimed:—"The treatment of incandescence electric lamp filaments for the removal of carbon therefrom in the manners hereinbefore described under the several examples." It seemed to him quite clear that the essential idea in the specification was the removal of carbon from the filaments by the use of certain specified chemical substances, though incidentally the phosphorus contained in these substances might be useful in other ways. The object in removing the carbon was to obtain a stronger and more serviceable filament. The defendants objected to the validity of the Letters Patent in question substantially on three grounds, namely, first, that the specification was misleading; secondly, that it was insufficient; and, thirdly, that the invention was not useful. In considering whether a specification was misleading or insufficient, it was material to consider to whom it was addressed, and, in his Lordship's opinion, the present specification was addressed to the manufacturer of incandescence electric lamps, and not to the chemist. If, therefore, the specification contained errors in chemistry, those errors were unimportant, except to the extent to which they might mislead the lamp manufacturer in carrying out what the specification told him to do. Errors in chemistry might very well lead the chemist to think the directions given impracticable and useless, and, consequently, to put the specification altogether on one side, while the manufacturer ignoring the chemistry, might proceed to carry out the practical directions given, and secure any beneficial results to be attained thereby. The specification in the present case appeared to say that the chemical substances to be used by the manufacturer, when heated *in vacuo*, gave off free nitrogen, and that this nitrogen combined with the carbon in the filament, and formed cyanogen. As a fact, however, free nitrogen (except in the intense heat of the electric arc), was not known to combine with carbon or produce cyanogen. Nitrogen, however, which was already combined with hydrogen in the form of ammonia (NH_3), readily left the hydrogen to combine with carbon. All the substances, the use of which was contemplated by the patentee, with the possible exception of phospham, readily gave off ammonia under the influence of heat, and the nitrogen element in the ammonia readily combined with carbon and formed cyanogen. It was, therefore, possible that the patentee used the expression nitrogen to denote nitrogen in the form of ammonia, rather than free nitrogen, and this would account for hydrogen being a necessary ingredient in every substance the use of which he contemplated. But however this might be, it did not appear to him that the manufacturer would trouble himself about a question of this sort. He would go to some chemist, obtain the substance he proposed to use, and apply it in the manner described. The main attack on the validity of the patent depended for its force on the direction given in the specification with reference to the use of phospham. Phospham was a name given by Gerhardt in 1846 to a substance obtained by first treating dry phosphorus pentachloride (PCl_5) with dry ammonia (NH_3), thereby obtaining a mixture of salammoniac and chlorophosphamide ($PCl_2 N_2 H_4$); and, secondly, by heating this mixture to redness for a quarter of an hour, whereby the salammoniac and hydrochloric acid were volatilised, leaving a powdery residue. He came to the conclusion that the residue he called phospham contained (1st) bi-phosphamide (PON); (2nd) pure phospham (PN_2H); and (3rd) a chlorine compound which he had been unable to isolate, but which had the property of being converted into phosphamide and salammoniac on contact with moisture. He added that pure phospham (PN_2H) could only be obtained if two conditions were fulfilled, namely, (1) a complete reaction between the perchloride of phosphorus and the ammonia used in its preparation; and (2) the absence of moisture. It followed that Gerhardt's phospham was distinguished from pure phospham, if it were allowed to absorb moisture, would produce phosphamide, and this would on heating readily give off ammonia. It was admitted on all hands that phospham, however prepared, and however nearly it approached its theoretical formula, had an affinity for moisture, and as soon as it absorbed moisture, partly decomposed into phosphamide, and that this phosphamide was not stable, but readily gave off ammonia at comparatively low temperatures. This fact, in his opinion, reconciled a good deal of the expert evidence which at first sight was absolutely contradictory. The conclusions he came to on the evidence were as follows:—It was impossible to get pure phospham (PN_2H); the nearer they got to this formula and the more careful they were to prevent the possibility of the substance they actually used from degenerating from this formula before they used it, the less likely were they to get the evolution of ammonia at a low temperature; and, on the other hand, however their phospham was made, if they used it as directed in the ordinary way and without any special precautions to preclude its degeneration by contact with moisture, then and in either of such cases, they would get the evolution of ammonia at a comparatively low temperature. The phospham used by the plaintiffs under the patent, and the phospham used by the firm in Berlin who supplied the infringing lamps under the corresponding German patent, was phospham made by Schuchardt, the only chemical manufacturer who, so far as the evidence went, was selling the article at the date of the patent. Mr. Swinburne and Mr. Ballantyne both made experiments with this phospham, and it undoubtedly gave off ammonia at low temperatures. Both Mr. Ballantyne and Dr. Hehner agreed that any phospham, however well made, under the ordinary conditions prevailing in a lamp manufactory would evolve ammonia at low temperatures if only because of the impossibility of keeping it free from contact with moisture at low temperatures. Under those circumstances, however wrong the patentee might have been in his chemistry, his Lordship did not think the lamp manufacturer would be misled into using a substance which did not act substantially in the manner described. Taking any phospham, however made, it would be a difficult matter to prevent it so acting, although from the theoretical standpoint of the formula PN_2H it ought not so to act. With regard to insufficiency, the only real point made under this head was that no direction was given in the specification for the preparation of phospham, or the other substances referred to, and that such substances were not sold in the market at the date of the patent, nor would even a skilled chemist have known how to prepare them. In his Lordship's opinion on the evidence, this objection failed. All the substances referred to were described in Watt's Dictionary of Chemistry, and the literature on the subject was there referred to. Further, Schuchardt, a German manufacturer, whose price lists were well known to English chemists, listed and sold the article. The other points in which the specification was said to be insufficient, were, he thought, disposed of by the fact that neither Mr. Swinburne nor Mr. Ballantyne, found any difficulty in carrying into effect the directions thereby given, and it was not suggested that anyone had tried to carry such directions into effect, and had failed. He was further of opinion that the evidence as to the utility of the invention was all one way. All suggestions as to its non-utility appeared to be based upon the action of pure phospham conforming with, or closely approximating to, the theoretical formula, and kept free from contact with moisture in a way which would be quite impossible under the ordinary conditions obtaining in a manufactory. If these suggestions were disregarded, and attention confined to ordinary phospham, however made, and which was used under ordinary conditions, the evidence that when used in each, and every of the manners specified in the specification, it did remove carbon from the filaments was really undisputed, the operative agent in such removal being nitrogen in the form of ammonia. It was true that only in one experiment which was made by Mr. Swinburne was the whole of the carbon removed. The remarkable point, however, was that when phospham was used, the carbon left in the filament did not lead to blackening of the globe, but when phospham was not used, the same, or even a less amount of carbon in the filament, led to blackening of the globe, and in this respect it appeared to have been immaterial at what stage of the process phospham was applied, or in what manner it was applied. Some stress was laid on the fact that the patentee asserted that by his process the last trace of carbon was removed. This was not literally true, but if, as shown by the evidence, the carbon which remained was rendered innocuous by the process, the inaccuracy did not affect the utility of the invention. He came to the conclusion, therefore, that the attack on the patent failed, and it only remained to consider whether the defendants had been guilty of any infringement. The defendants had sold lamps treated with Schuchardt's phospham in the globe of the lamp in precisely the same manner as was directed in the specification. It was said, however, that they had not by such treatment removed carbon from the filament, inasmuch as the carbon in the filament before treatment had already been reduced to ·014 per cent., or, in other words, so low that the filament was practically already free from carbon. It was said, too, that this being an invention for removing carbon, the onus lay upon the plaintiffs to prove that the defendants had, by using the process, removed carbon. It appeared impossible to prove with absolute certainty that a particular treatment had removed carbon from a filament, unless it were possible to prove the amount of carbon which the filament contained before treatment. Of course, from the nature of the case, the plaintiffs could not do this; and, as a matter of fact, the defendants had not proved that the carbon in the particular lamps in question was as low as ·014 per cent. before treatment. All they had to prove was that sintered

filaments made by them generally contained only this amount of carbon. Further, there was no satisfactory evidence that ·014 per cent. of carbon in a filament would not have had a bad effect if the filament had not been treated with phospham, or that phospham used in the lamp, according to the plaintiffs' process, would not reduce the carbon still further. He was satisfied that the process in question normally operated to remove carbon from a filament, and it was admitted that the defendants used the process on a filament containing carbon. Under these circumstances a jury would be entitled to draw—and sitting as a jury he was entitled to draw—the inference that the defendants did remove carbon by means of the process, unless the defendants gave evidence to the contrary. This they had failed to do, and he accordingly held that they were guilty of an infringement of the plaintiffs' patent.

Mr. Colefax asked for an injunction, an inquiry as to damages, delivery up, and costs, and, in addition, a certificate that they had had proved their particulars of breaches, and a certificate that the validity of the patent came in question.

Mr. Justice Parker assented, and on the application of Mr. Terrell, his Lordship granted a stay on the usual terms.

Tramcar Accident Claim.

In the King's Bench Division, before Mr. Justice Jelf and a common jury, on January 14th, Miss Sara Jacobs, a trained hospital nurse and certificated masseuse, sued the London County Council to recover damages for injuries she sustained through being knocked down by an electric tramcar near Dunsmure Road, Stoke Newington, on October 16th, 1908. It appeared that the plaintiff alighted from one car, and when crossing the road was knocked down by another coming from the opposite direction. She admitted in cross-examination that after she got out of the car, she immediately turned to her left, and did not look to see if another car was coming, and also that she was in a hurry, and her head was bent. At the close of the plaintiff's case defendants' counsel submitted there was no case to go to the jury, a contention which was upheld by Mr. Justice Jelf, who entered judgment for the County Council.

Electrical Colliery Fatality.—Damages.

The Stirling Court of Session has awarded £75 with expenses to a Loanhead colliery engine keeper who sued a firm of coalmasters for damages for the death of his son, who was killed at No. 4 pit, Polmaise Colliery. Deceased was employed as an underground electrical motorman. On the day of the accident he observed a crackling at and sparkling from the wires used for lighting and power purposes. He went to the switchboard to cut off the current and was in the act of pulling out the switch, when he received a shock which killed him. Pursuer attributed the accident to certain defects which prevented the switch from being properly protected. Defenders denied fault. The Court found that death was caused by an electric shock received by touching the switchbox; that by some leakage the switchbox had become "alive" with electricity; that the deceased would not have received the shock but for the fact that the switchbox and tubing connected with it were not properly earthed; and that, therefore, the defenders were responsible for the accident.

Luscombe *v.* Fryer.

Mr. Muir Mackenzie, one of the High Court Official Referees, delivered a considered judgment on Saturday, March 12th, in this case, evidence in the hearing of which was reported in our last issue.

Mr. Mackenzie said that the plaintiff had been employed as manager of the electrical department of the defendant's firm on January 16th last year, on terms that he was to be paid £100 a year salary and commission on profits on new orders or work put in hand after January 1st, 1909, and there was a provision in the arrangement between the plaintiff and the defendant that the plaintiff should draw £10 a month, partly on salary, and partly on account of commission. On April 13th the plaintiff was dismissed by the defendant. He had been paid in respect of salary £20 6s. 8d., and £4 3s. 4d. on account of commission. The question to be determined was whether the dismissal was justified. The learned Official Referee intimated that as this was a case of importance, and inasmuch as his decision might be questioned hereafter, he thought it right to enunciate the authority upon which he acted and the principle he proposed to apply.

Having cited the case of the Boston Deep Sea Fisheries *v.* Ansell, decided by the late Lord Justice Bowen, Mr. Mackenzie, referring to the present proceedings, remarked that at the time of Mr. Luscombe's dismissal there were three important undertakings going on—the Carshalton undertaking (for the Metropolitan Asylums Board), the Crosby Hall undertaking, and the Rigby Battcock undertaking. Both of the two latter were pressing, and under the management and control of the plaintiff, and for both of them the pressure was such that the work was kept partly going during the Easter holidays. The plaintiff had absented himself by going off for a holiday on the Thursday before Easter day. He did not report himself until late in the day on Tuesday. That was not a solitary matter; it had been stated that during the plaintiff's term of office his conduct was not satisfactory, that some appointments made with persons of importance were not kept, and that in respect of materials, plaintiff did not exercise judgment or take pains to inform himself as to what was required. He (the Official Referee) thought that the real matter of importance was the plaintiff's going away without leave and without notice and leaving these three undertakings without any supervision. He (the Referee) did not wish to say a word that would prejudice Mr. Luscombe in his future career. It appeared to him, putting these matters aside, that the plaintiff was a gentleman of ability, education and industry, and one might hope that he might well have a prosperous and successful career before him. He could not, however, but say that on the evidence the plaintiff had committed a very grave mistake, and that the defendant was in the circumstances justified in putting an end to the relations between them. That decision, to his mind, destroyed the claim to allow arrears of salary and the claim for salary due in lieu of notice, and, in his opinion, it also destroyed the claim for commission on jobs not completed. On the other hand, he held that his decision did not destroy plaintiff's right to commission already earned. It appeared to him, however, that the commission so earned upon the things actually completed came to less than £4 3s. 4d. which the plaintiff had already received. Therefore, on the whole, there must be judgment for the defendant, with costs.

Lund Bros. *v.* The Novel Electric Theatres, Ltd.

This was an action by a firm of electrical and general engineers of Queen Victoria Street, to recover £39 odd for work done and goods supplied. The case was heard last Friday in the Westminster County Court.

Mr. Mellor, for the plaintiffs, said that their case was that their traveller introduced the business, and they sent defendants an estimate for work at their premises at Rupert Street, Soho. The order followed, and the work was done. It was now contended that one, Jackson, was liable. The estimate was sent to the company, and the work was done on the company's premises. Credit was given to the company, and one of the items was for a bioscope switchboard, so that part must be for the benefit of the company. The company was written to for payment, and after that the secretary of the company wrote to plaintiffs to put right certain things in connection with the installation. It was true that there had been communications with Jackson, but that was as the engineer who had the matter in hand for the company, and that did not prove that plaintiffs gave Jackson credit.

Evidence having been given for the plaintiffs, Mr. Davis, counsel for the defendants, submitted no case had been made out.

His Honour Judge Woodfall agreed. He was of opinion that no case had been made out against the company. As to the order from the secretary, it had been admitted that that had reference to extras necessary to the contract, and were part of the contract. The mere fact that the work was for the benefit of the company did not make the company liable. The estimate was sent to the company, and then, in consequence of what the traveller who took the order told plaintiffs, they communicated with Jackson, and stated, "We are in receipt of your esteemed order." He entered judgment for the defendants, with costs.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Hospital Lift.

On the occasion of the opening of the Hospital for Invalid Gentlewomen, Lisson Grove, by the Prince and Princess of Wales, on Monday last week, the new automatic electric passenger lift installed by Messrs. Smith, Major & Stevens, Ltd, was used by their Royal Highnesses. This machine, which is of the push-button type, is up to date in every respect. On entering the cage the landing door must be closed and locked by the simple movement of a lever; if the door is not locked, the control circuit is interrupted and the cage cannot be moved. In the cage are placed a number of button-pushes corresponding to the number of floors served. Momentary pressure of any button will send the cage to the corresponding floor, where it stops, and the door may be opened and the passenger can alight. A stop-button is also provided to stop the cage if a wrong button has been pressed. When the lift is in use, all the controlling buttons are dead, so that interference with the passenger using the lift is impossible. No door can be unlocked or opened when the cage is not standing opposite that particular door. The action of locking a door simultaneously restores the electric circuit.

We understand that Messrs. Smith, Major & Stevens, Ltd., have recently erected eight lifts working on this principle at the new offices of the *Morning Post* newspaper, Strand.

Earth Plates for Lightning Conductors.

During the last three years the L.C.C. has been using an earth plate in connection with lightning conductors, in which tongues are cut and bent outwards to form a number of points at which any discharge may readily take place.

Fig. 1 shows the arrangement in detail for earth plates 3 ft. × 1 ft. 6 in. It was the custom until recently to use two such earth plates with a branching tape; this has recently been modified and one plate 3 ft. square only is now used, of No. 16 gauge copper, with the conductor riveted and soldered the full length of the plate. Each plate has four rows of triangular tongues with the

tips in adjacent rows pointing in opposite directions; each tongue is 3 in. long and tapers from 2 in. wide to a point, and the tongues point upwards when the earth plates are laid in position.

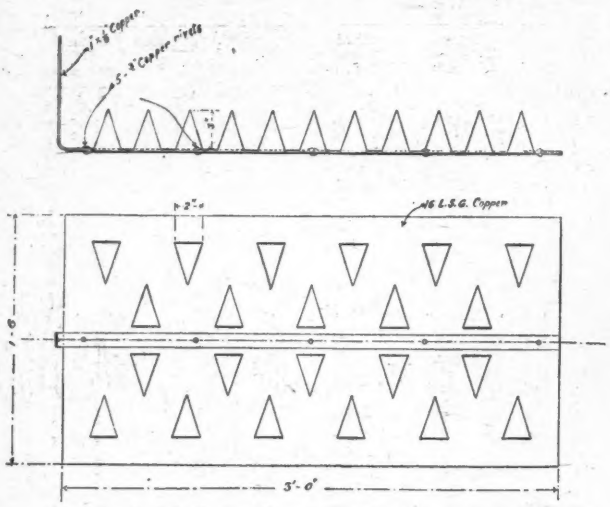


Fig. 1.—L.C.C. Earth Plate for Lightning Conductors.

The loose earth or wood-charcoal is filled in and well rammed on to the top of this plate. It will be noticed that the plate possesses the characteristics of that recently proposed by Sir Oliver Lodge in connection with the Elan Valley works protection from lightning scheme.

The Verity-Barlow Lift.

Messrs. Veritys, Ltd., have recently taken over the sole manufacturing rights of the Barlow patent lift, which, it may be remarked, can only be employed for two floors, but which, owing to its simplicity and efficiency, is particularly adapted for such use. The hoist gear is an adaptation of a well-known mechanical device—the block and tackle—for a special purpose and in a novel manner.

Reference to our figures will show that the lift gear consists of a Verity motor driving through enclosed worm-gear and pinions on to two spur-wheels placed one on either side of the lift gear. A

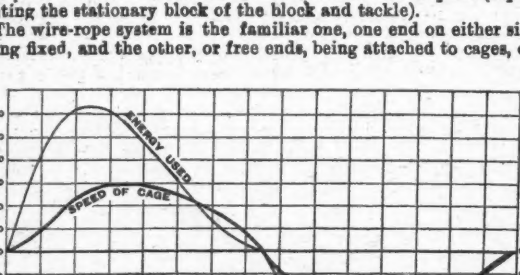


Fig. 2.—Views of Lift Gear, showing Spur Wheels, Sheaves, &c.

diametrically opposite arm in each spur-wheel is enlarged to carry a pin, on which revolve a number of sheaves, while two similar groups of sheaves are attached to either side of the bedplate (representing the stationary block of the block and tackle).

The wire-rope system is the familiar one, one end on either side being fixed, and the other, or free ends, being attached to cages, or,

Fig. 3.—Characteristic Curves for One Cycle; 5 cwt. Lift; Travel 12 ft.

where only one cage is used, to a cage and balance weight respectively.

It will be evident that when the gear is run the spur-wheel sheaves are alternately brought near to and carried away from the stationary sheaves, the free end of the rope, attached to the cage, moving several times the horizontal travel of the moving sheaves, according to the number of sheaves employed; also that each revolution of the spur-wheel corresponds to one upward and one downward travel of the cage. Considering the moving sheaves, it will be seen that they have two dead points as regards the stationary sheaves—corresponding to the highest and lowest positions, or stopping points, of the cage; between stops the cage accelerates or decelerates automatically, reaching its maximum speed midway between floors, the operation being purely a mechanical one. When started, the motor runs at full speed until at the end of the cage travel, the circuit is automatically broken by a knock-off cam and the motor stops; the motor obviously starts and stops at no-load

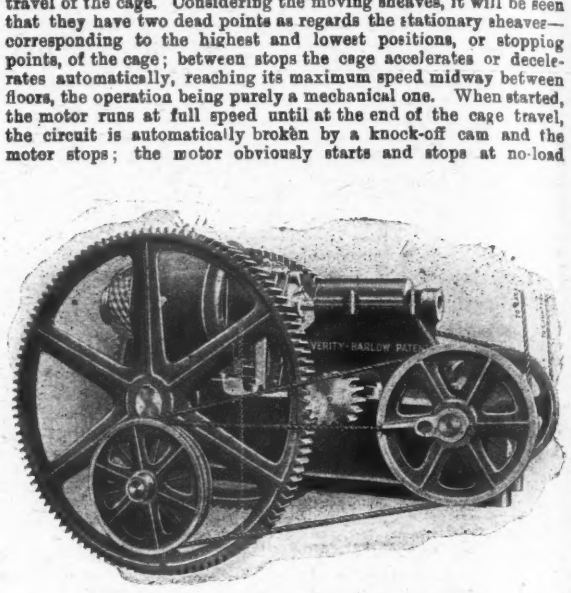


Fig. 4.—The Verity-Barlow Lift Gear.

(*i.e.*, the dead points), thus facilitating the use of the single-phase motor, and, as the gear only runs in one direction, reversing difficulties are got over.

The cage cannot overwind; even if the automatic stop failed, it could only travel up and down.

Some seven different sizes of the Verity-Barlow gear are at present on the market, for dealing with loads of ½ cwt. to 30 cwt.; owing to its simplicity and peculiar adaptability for communication between two floors, this lift has obvious advantages in such positions.

PARLIAMENTARY.

Electric Bills and Provisional Orders.—The Board of Trade in their report on the Private Bills before the present session of Parliament, state that there are 11 Tramway Bills under which it is proposed to raise £1,914,960 by loan, and nothing by the issue of shares. Under the Bills the construction of 28 miles of tramway is proposed. As compared with 1909, the number of Tramway Bills shows a decrease of seven, and the capital proposed an increase of £815,220. Ten of the Bills relate to England and Wales, and one to Ireland. There are five Bills relating to the supply of electrical energy, including three which are promoted by gas companies. Sums amounting to £416,000 are proposed to be raised. Of Railway Bills proposed, eight deal with electric railways, and three propose to authorise the construction of new electrical railways or extension of existing lines in or near the metropolis. Of the Provisional Orders, three relate to tramways, viz., Huddersfield Corporation, Milnrow U.D.C., and Rawtenstall Corporation. The total length of new tramways proposed is 2 miles 7 c. double line, and 4 miles 63 c. single line, and the total estimated cost is £67,376. There are 26 electric lighting provisional orders relating to Ardrossan, Saltcoats and district, Ballyclare, Bath, Brixham, Brumby and Frodingham, Cambuslang, Chesham, Church, Clevedon, Cowdenbeath, Lochgelly and district, Dawlish, Derby, Frimley, Gorseinon, Huddersfield, Nanen, Ormskirk, Radcliffe, Runcorn and Weston, Runcorn Urban, Skelmorlie and Wemyss Bay, Smethwick, Swinford, Templemore, and Widnes. The total capital proposed under the Electric Lighting Provisional Orders is £190,622.

Government Contracts and Fair Wages.—Mr. Bowerman asks the Secretary to the Treasury to state how many Government Departments have representatives upon the Advisory Committee appointed to ensure that contractors for Government work, in the carrying out of their contracts, comply with the Fair Wages Resolution of the House of Commons; and whether the members of the Committee meet periodically to consider all contracts before they are entered into, for the purpose of verifying the *bona fides* of the persons tendering, or whether they meet only after complaints have been received regarding the non-observance by any contractor of the terms of the Fair Wages Resolution?—Mr. Hobhouse replies that the Departments represented on the Fair Wages Advisory Committee are the War Office, Admiralty, India Office, Post Office, Office of Works, Stationery Office, Irish Board of Works, and the Crown Agents for the Colonies. The chairman of the Committee is the Comptroller-General of the Labour Department of the Board of Trade. The Committee meets from time to time and the subjects for consideration are best indicated by the terms of the reference, which are as follows: "To advise the Departments

of Government dealing with contractors as to the form of clauses in contracts by which the resolution of the House of Commons of March 10th, 1909, can best be carried into effect, and as to the methods of securing observance of such clauses, and generally to make such recommendations as they may deem advisable to promote uniformity of administration and co-operation between departments in dealing with the question of the payment of fair wages by Government contractors." The general procedure with regard to complaints of non-observance of fair wages clauses is substantially that laid down in paragraphs 121-124 of the Report of the Fair Wages Committee, which was presented to Parliament in 1908.

Submarine Cable to Canada.—Mr. H. Lawson asked Mr. H. Samuel whether any proposals are now under consideration with reference to a submarine cable direct from the Dominion of Canada to this country, and whether the Canadian Government had taken any action in the matter. Mr. Samuel stated that no proposals are at present under the consideration of the Government with reference to the provision of a submarine cable between Canada and this country, and, so far as he is aware, the Canadian Government have taken no action in the matter.

Electric Lighting of Army Out-stations.—Replying to a question in Tuesday's Parliamentary Papers as to what are the out-stations referred to in the Army Estimates which it is proposed to supply with electric lighting, Mr. Haldane informs Mr. Salter that the stations are Deepcut, Ewshot, and Blackdown. The lighting is provided by an extension of the present installation at Aldershot.

Mersey Railway.—This Bill passed the Unopposed Committee of the House of Lords on Tuesday.

BUSINESS NOTES.

Book Notices.—"The Aeroplane Portfolio." London: Percival Marshall & Co. Price 1s. net.

"The *Model Engineer* Laboratory and School of Mechanics." 1910. London: Percival Marshall & Co.

"*Journal* of the Western Society of Engineers." Vol. XIV, No. 6. December, 1909. Chicago: The Society. Price 50 cents.

"Science Abstracts." Sections A. and B. Vol. XIII, Part 2. 1910. London: E. & F. N. Spon. Price 1s. 6d. each.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXVI, No. 2. February, 1910. New York: The Society.

"The Physical Review." Vol. XXX, No. 2. February, 1910. Lancaster, Pa.: The Macmillan Co. Price $3

Transactions of the Academy of Science of St. Louis." Vol. XIX, No. 1. February 18th, 1910. St. Louis: The Academy

"*Journal* of the Franklin Institute." Vol. CLXIX, No. 2. February, 1910. Philadelphia: The Franklin Institute. Price 50 cents.

"Clarkson Bulletin." Vol. VII, No. 1. January, 1910. Potsdam, N.Y.: The Thomas S. Clarkson Memorial School of Technology.

"Law and Practice of Rating and Assessment." By C. A. Webb. 1910. London: Crosby Lockwood & Son.

"Illumination and Photometry." By W. E. Wickenden. 1910. London: Hill Publishing Co., Ltd.

"The Depreciation of Factories." By Ewing Matheson. Fourth edition. 1910. London: E. & F. N. Spon, Ltd. Price 10s. 6d net.

"The Conflict in South Wales." Coal Trade Pamphlets, No. I. London: *Colliery Guardian*. 1910. Price 1d.

"Constitution and List of Members of the American Society of Civil Engineers." February, 1910. New York: The Society.

"*Journal* of the American Society of Mechanical Engineers." Vol. XXXII, No. 3. March, 1910. Baltimore: The Society.

"The Life of Lord Kelvin." By Silvanus P. Thompson. Two vols. London: Macmillan & Co., Ltd. 1910. Price 30s.

"The Technical Index." Vol. XV, No. 6. March, 1910. London: M. J. FitzPatrick, 88, Chancery Lane.

Coming Canadian Business.—The following items are, according to the *Canadian Engineer*, included in the supplementary estimates of the Provincial Treasurer:—

Electric plant, Hamilton Asylum	$13,000
Electric plant, London Asylum	$35,000
Electric plant, Ontario Agricultural College, Guelph ..	$15,000
New wing at Osgoode Hall	$50,000

A Siberian Exhibition.—There is talk of a projected Siberian Scientifico-Industrial Exhibition at Irkutsk.

Annual Ball.—The staff of Messrs. Bruce Peebles and Co., Ltd., held their annual ball at the North British Station Hotel, Edinburgh, on Friday evening last. Mrs. Lee Murray (wife of the general manager of the company) received the guests. Amongst those present were several of the directors, as well as branch managers, outside representatives and agents of the company and their wives. Mr. Lee Murray presided at the supper. After the toast of "The King" had been honoured, Mr. W. V. Waite (works manager) proposed "The Firm," which was responded to by Mr. C. J. Shields and Mr. A. B. Anderson (directors). Mr. C. J. Hunt proposed "The Guests," which was responded to by Mr. Robert Graham and Mr. J. H. Bunting, who also proposed the health of the chairman. The keynote of the speeches was loyalty and enthusiasm in the interests of the firm. About 150 ladies and gentlemen were present, and a most enjoyable evening was spent.

Electric Lift Contracts.—The electric lift contract for Messrs. Richard Clay & Sons' new printing works now building in Southwark, has been given to Mr. J. Stannah. Five lifts in all have been provided for, namely, four goods lifts to deal with loads of one ton, at a speed of 80 ft. per min., and a passenger lift to deal with a load of 7½ cwt. at 120 ft. per min. The whole of the lifts will be provided with push button control. The construction is to be such that no woodwork is to be used in any portion except in the cage of the passenger lift. The method of driving will be on what is known as the V-sheave principle, the sheaves being driven by means of worm-geared electric motors. The lifts are being made in accordance with the specifications of Mr. Frank Broadbent, the consulting engineer to Messrs. Richard Clay and Sons.

Turkey and Electrical Concessions.—On the authority of the Belgian Legation at Constantinople, the Turkish Minister of Public Works recently drew up a general memorandum relating to electric lighting and traction, and, with a view to the granting of a large number of concessions for electric tramways, electric lighting and power plants, a circular was sent to the principal towns in Turkey, requesting the local authorities to state their views thereon, within one month.

Exhibitions.—The North British Technical Exhibitions Association, Ltd., is arranging a series of light and heat exhibitions throughout the principal cities and towns in Scotland, where the Corporations or other municipal authorities own the electrical and gas power stations. The first of these will be held at the Drill Hall, Paisley, from April 16th to 23rd next, inclusive.

Arc Lamp Lowering Gear.—We are informed that the London Electric Firm's centre carrier lowering gear has been fitted at Ealing, Westminster, Oxford Street and Upper Regent Street, London; Melbourne, Australia; Croydon, Cardiff, Eastbourne, Grimsby and Rawtenstall. In Westminster some of the existing carriers have been converted to the new system.

Electrical Trade in Russia.—The Russian correspondent of the *Financier* reports that, according to the *Yuzhnava Rossia*, the enlargement of the central station power by at least 25 per cent. is urgently needed owing to the present plant being overworked.

The *Tehern Pober* says the plans for the new town electric station of Tiflis are now ready. The Town Council has instructed the engineer to prepare plans for a hydraulic station in the river Kure in connection with the electric plant, which is estimated to cost 500,000 roubles. To this may be added the note from the *Kavkaz* that the company that works the Tiflis funicular is asking permission to build the Kodzhorsky Railway along the crest of Mount St. David. The *Ter Viedomosti* says a project is on foot to connect Tiflis and Baku by aluminium telephone wire, to cost 320,000 to 400,000 roubles.

The Town Council of Piatigorsk has received an offer from L. P. Titz for a 37½ years' electric power concession; he is prepared to supply power from a station to be built on his own ground, says the *Piatigorsk Echo*. Efforts to get Siemens & Halske to build the station on credit have failed. The firm required 40 per cent. down, and 60 per cent. in a year after delivery of the station. Another contractor, E. A. Tzart, is said to have made a more favourable and acceptable offer.

The Moscow-Caucasian Co. is putting an electric station on its Romaninsk property, and purposes supplying current to its neighbours, besides meeting its own needs. The company has hitherto had its current from the local house, "Electric Power."

The engineering firm, Erikson, has instructions to establish the electric light (5,000 H.P.) on the Romaninsk estates, likewise in Caucasia.

The town of Poltava is negotiating seriously with a number of houses for the construction of the Poltava tramways, but it is not yet decided whether the enterprise will be undertaken by the town or let out.

Goods traffic on the Krementchug tramways system is now begun, and, contrary to expectation, is not interfering with the regular passenger traffic, and a great extension of goods traffic is expected, in view of which it is proposed to lay special goods lines along certain thoroughfares.

Since the town electric station was erected at Warsaw a number of small industrialists have installed motors in their own homes, which enable them to do what could only be done hitherto in large factories. This is producing quite a local revolution, and is causing the large lamp makers to suffer terribly. One of them has had to close down, simply because the bronzers with their little motors are making lamps themselves, and at prices with which the large factories cannot compete.

For Sale.—The Paisley Corporation has for disposal one 350-kw. steam alternator, five Ferranti rectifiers, and about 150 Wright's maximum-demand indicators. For particulars see advertisement in this issue.

Liquidations.—Electrical Installation Co., Ltd.—A meeting of creditors is to be held at Manchester on March 21st.

Glamorgan Tram and Constructional Works, Ltd., Pontyclun, R.S.O., Glam.).—Liquidator (with a committee of inspection), Mr. C. E. Dovey, 1, Queen Street, Cardiff. Appointed March 3rd.

Meter Approved.—The B. of T. has approved of the Siemens-Schuckert meter for continuous current (Type GK.), deposited on behalf of Siemens Bros. Dynamo Works, Ltd., in 1905.

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Osram Lamps for Buckingham Palace and the Post Office.—An important contract has just again been secured by the General Electric Co., Ltd., for the supply of tungsten-filament lamps of 16, 25, 32, 50, 100, 200, 300 and 400 c.p. to the Post Office for their requirements all over the United Kingdom for the ensuing six months. It may be mentioned that the Osram lamp has held this contract for the past year. A further order has also been placed with the General Electric Co., Ltd., for the supply of 100-210-volt 32-c.p. half-obscured Osram lamps for use in Buckingham Palace, to the order of His Majesty's Office of Works. Large numbers of Osram lamps are, we understand, already installed in Buckingham Palace.

Bankruptcy Proceedings.—Alan McAlpin (trading as McAlpin & Co.), electrical engineer, 44, Crank Street, Leicester, and at Cumbergate, Peterborough.—The first meeting of creditors herein was held on Thursday last week, at the Official Receiver's office, 1, Berridge Street, Leicester. The Official Receiver said that proofs had been lodged amounting to £1,568 out of total liabilities of £2,068. Mr. Lewis Vincent Wykes, of the firm of Wykes & Co., chartered accountant, of Leicester, was appointed trustee with a committee of inspection consisting of Mr. Arthur Jopling, London, electrical engineer; Mr. W. Baker, Leicester, warehouseman; and Mr. T. S. Hurley, Leicester, electrical engineer.

Samuel Emerson Smith, electrical engineer, Coulby House, Carholme Road, late 271, High Street, Lincoln.—This debtor attended at the Sessions House, Lincoln, last week for his adjourned public examination, before Mr. Registrar R. A. Stephen. The case had previously been adjourned in order that the debtor might furnish accounts of his dealings just prior to filing his petition. The Official Receiver said he had no further questions to put to debtor, who was allowed to pass.

Alfred Horswill Gibbings, engineer, 17, Gambier Terrace, Liverpool.—A receiving order was made on March 10th.

R. Foster & W. Baker (Robert Foster & Co. and the Nelson Electrical Engineering Co.), plumbers and electrical engineers, Nelson & Burnley.—Supplemental dividend 1s. 11¾d. in the £, payable from March 18th, at 13, Winckley Street, Preston.

Trade Announcements.—Mr. R. J. Chatham has commenced business as an electrical engineer and contractor, at 181, Brighton Street, Egremont, Cheshire.

We observe from the *Canadian Engineer* that the Bergmann Electrical Works, of Berlin, are in reducing their tungsten lamps into the Canadian market. Dr. Rossner, late assistant secretary of the Montreal Trust Co., is acting as their representative. If the business is found to justify the step, branch works will be established for the manufacture of the lamps in Canada. The recent alteration in the tariff arrangements between Canada and Germany means that these lamps will enter Canada from that country at an average duty of about 30 per cent., instead of 40 per cent., as formerly.

Mr. Henry Tinsley notifies that the partnership between himself and Mr. Arthur Snell has been dissolved. He is continuing in business at the same address (Stanley House, Eldon Park, South Norwood, S.E.), and will trade as H. Tinsley & Co. Additions are being made to the works and laboratory equipment, and the firm will specialise in cadmium cells, potentiometers, and high-class measuring instruments, including Dr Drysdale's polyphase wattmeters, alternate-current potentiometer, and phase-shifting transformer for which a special one, two and three-phase machine is being installed.

We are informed that the Locke Insulator Manufacturing Co., of Victor, N.Y., have purchased the plant and business of the Lima Insulator Co., and that in future the whole of the insulators turned out by these two works will be sold under the name of "Victor," the name of "Lima" now becoming obsolete. The combined capacity of these two works represents 15 kilns, all devoted exclusively to the production of high-voltage porcelain. Messrs. Wm. Geipel & Co., of 72A, St. Thomas' Street, London, S.E., continue to act as European agents for this concern.

Messrs. Hamilton Bros. have moved to new premises at 182, West George Street, Glasgow.

Catalogues and Lists.—Messrs. L. Andrew & Co., 2, Carr Street, Blackfriars, Manchester.—Revised (reduced) price list of "Wrendal" metallic-filament lamps.

Messrs. Krupka & Jacoby, 11, Queen Victoria Street, E.C.—A number of lists giving prices and particulars of the following: Carbons for open and enclosed arc lamps; 16 c.p. tantalum lamps; flexible wires; instruments for testing incandescent lamps; Lessing's dry battery.

Messrs. Henry Sotheran & Co., 140, Strand, W.C.—The first part of the Supplement to their "Bibliotheca Chemico-Mathematica," which they claim is the fullest catalogue of works on the exact sciences ever issued by a bookseller.

The Abbey Electric Co., 17, Victoria Street, S.W.—Eight-page pamphlet giving a few particulars concerning, and prices of, the "Abbey" double-carbon arc lamp.

The Sterling Telephone and Electrical Co., Ltd., 200, Upper Thames Street, E.C.—Publication No. 159, dealing with the Sterling patent electric blasting machines. This pamphlet contains a quantity of useful information about electric blasting in general, besides giving a full description and instructions for the use of the Sterling machines. Two new patterns are of especial interest—type BDK (1910 model), which is capable of firing five shots in series, and is of remarkably compact design; and type ABC (1910 model), which fires 10 shots in series, and is also of new design. These two machines are supplied only in nickel-plated brass cases. Other exploders are listed, firing from two to 80 shots simultaneously, and various accessories, spare parts, &c., are shown.

Messrs. Alfred Herbert, Ltd., Coventry.—A most effectively illustrated pamphlet of 22 pages, dealing in an exhaustive manner with the firm's patent roller steady turner as applied to their hexagon turret lathe. It has on the front cover a coloured illustration which is truly "striking."

Mr. G. Wuthrich, Oswaldestre House, Norfolk Street, W.C.—Supplementary leaflet, copies of which may be obtained on application, illustrating a new design for column and work-table in connection with the Oerlikon electric hand-drilling machines.

The Wellington Tube Works, Ltd., Great Bridge, Staffs.—Folding card tabulating approximate net prices of wrought-iron tubes (⅛ in. to 6 in. diameter), at discounts 35 per cent. to 90 per cent. off standard trade list for gas, steam and water tubes. Copies of the card, which has been issued to help tube buyers to overcome the present intricate discount system, can be obtained on application by those interested.

Messrs. Litholite, Ltd., 55, Hackney Grove, N.E.—New price lists of Litholite handles, bushes and washers, insulators and caps.

The Bastian Meter Co., Ltd., Bartholomew Works, Kentish Town, N.W.—Booklet relating to the improved Bastian electrolytic meter, 1909 pattern, which is guaranted free for three years, and registers the electricity consumed by even the smallest metallic-filament lamps; it has no mechanism, and is unaffected by short-circuits or overloads.

Messrs. Arthur Jopling & Co., 10, Westmorland Buildings, Aldersgate Street, E.C.—Eight-page catalogue of "Sunny" flame and enclosed arc lamps.

LIGHTING and POWER NOTES.

Accrington.—It was announced at the T.C. meeting last week, that the practice of wiring premises for consumers on the hire-purchase system was not working satisfactorily, and the chairman suggested its discontinuance, and the substitution of a deferred-payment system. Under this, 10 per cent. of the cost of the installation will be charged each quarter.

Australia.—The Sydney Council has under consideration a scheme submitted by the city electrical engineer for the storage of 6,000 tons of coal near to the power house, in order to guard against interruptions of the supply through coal strikes, &c. The estimated cost of the scheme is £14,300.

Plans and specifications for the new Kent Street sub-station have been approved by the Sydney Electric Lighting Committee. The accommodation provides for a battery-room on the ground floor, while the first and second floors will be utilised for machinery. Two other floors will be set apart for the storage of electric lighting materials and for offices. The estimated cost is £20,000.

Bristol.—The Electrical Committee has decided to concentrate the clerical department, engineering staff and showrooms in one building in the Exchange, Corn Street.

British Columbia.—The *Electrical World* contains some details of the scheme of the Western Canada Power Co., which is constructing a hydro electric plant 35 miles from Vancouver City. The plant is located on the Stave River, and by the construction of a dam 50 ft. high above the power house, a reservoir of nearly 20 sq. miles area will be secured, giving a head of 100-120 ft. Four 13,000-h.p. turbines coupled to 7,500-kw generators are provided for; two units are on order—the turbines of the double Francis type, designed for 225 r.p.m. and of Escher Wyss make, being coupled to Canadian G.E.C. generators. The supply will be stepped up to 60,000 volts for transmission over a steel tower line to Vancouver. The company has a second power site three miles below the first, and hopes to develop a maximum of 80,000 h.p. to 100,000 h.p.

Burnley.—The Corporation's annual estimates have just been prepared. These show that the profit estimated to be produced next year by the electricity works is £4,000, compared with £3,000 last year, whilst the estimated profits of the electric tramway undertaking are £3,649, compared with £6,000 last year.

Burslem.—In March, last year, Mr. Ashton Bremner, the borough electrical engineer, reported on the necessity of extensions to the electricity plant, and these have since been carried out, the formal inauguration taking place on Tuesday. The extensions mark an interesting departure from previous practice, a 600-kw. Belliss-Siemens mixed-pressure turbine plant having been installed, taking exhaust steam from three reciprocating sets and additional live steam as required. Condensing plant and a cooling tower have been supplied by Messrs. Isaac Storey & Sons, an additional Babcock boiler has been installed, and various other improvements carried out. Speaking at the Town Hall, the chairman of the electricity department, referring to the local electricity undertakings, said that the generating costs at Burslem, Stoke and Hanley were ·84d., ·98d. and 1·34d. per unit respectively, the average selling prices being 1·55d., 1·71d. and 2·46d.; out of the 953,677 units sold, 704,866 units were for power purposes. Mr. Ashton Bremner, referring to power supply in the neighbourhood, said they had sold 209,000 units at ½d. per unit, 111,000 at ¾d., and some 400,000 units at or about 1d. per unit. About 200,000 units were sold for lighting purposes, and it had been found very difficult to develop the lighting side with an official gasworks in the town.

Canada.—The Long Sault Development Co. and the St. Lawrence Power Co. have applied for authority to dam the Long Sault Rapids in the St. Lawrence River, near Cornwall. The scheme, which is meeting with much opposition, proposes the erection of 40-ft. dams and three power plants, whereby over 600,000 H.P. could be obtained—an amount equal to the proposed Niagara power development. Only 100,000 H.P. of the total would be developed in Canada. The International Waterways Commission has had the matter under consideration.

Castleford.—It is anticipated that the electric supply for lighting will be available by about May 1st. The supply is being provided by the Electrical Distribution of Yorkshire, Ltd.

Chelmsford.—The R.D.C. has, by 14 to 2, refused sanction to overhead mains being used by the Electric Supply Co. for supplying energy to Great Baddow. The old objection that overhead mains were "unsightly and dangerous," was given.

Continental Notes.—FRANCE.—A B. of T. Blue Book, dealing with electric power and light in Paris, mentions that the city supplies electric power and light from its own plants to the Central Markets, the Hôtel de Ville and other municipal buildings, and the public roads in the neighbourhood of the Buttes-Chaumont and Monceau Parks. There are also many private plants, but the general public and private lighting of the city has hitherto been in the hands of "conceded" companies, each of which exploited a fixed area. Their combined capital was £2,000,000, and in 1906 they paid the city £72,570 in royalties. The concessions of these companies expired in 1908, however, and the city has concluded new contracts, assigning to them and to a new enterprise spheres of influence within which they will enjoy practical monopolies. It now leases to the companies the cables and plants which had passed into its possession by the lapse of old concessions, and in return it will receive a payment of 10s. per mile of road cabled and 10 per cent. of their gross receipts (with an increase according to the profits), the minimum payment being £120,000.

ITALY.—La Société Elettrica Moltrasima is the name of a new company which has recently been formed at Moltrasia to put down a plant to utilise the water power of the river Vesporina, near the town, in the generation of electrical energy for lighting and power purposes.

There is about to be opened in Upper Italy a new hydro-electric station called the Cismone, which will eventually have a capacity of over 20,000 H.P. The Cismone is a small torrent which rises near Primiero, in the Tyrol, and, entering Italian territory, falls into the river Brenta, near Bassano. There has been built across the water-course a 35-metre high masonry dam, which encloses about 6,000,000 cubic metres of water, and forms an artificial lake 2 km. in length. The water is conducted by tunnels and pipes to a central station built near Fonzaso, in the province of Belluno. The station is already equipped with three generators developing 3,500 H.P. each. Transformers raise the pressure to 35,000 or 60,000 volts, energy being distributed in the Padua, Vicenza, Rovigo, Bellune and neighbouring districts. The cost of the installation will total some 2,000,000 lire, half of which sum was expended on the hydraulic works alone.

A new company has lately been formed in Florence, with a capital of £80,000 and the title La Società Idroelettrica del Brasimone, to put down plant at Camugnano to utilise certain available water power at that place in the generation of electrical energy for lighting and power purposes.

GERMANY.—The town authorities of Geislingen, in the province of Württemberg, have decided to support the Alb-Elektricitätswerke, a co-operative society whose central station is situated at Altenstadt, with whom they have arranged a 25 years' agreement. The contract includes the supply of energy for agricultural purposes, the prices for which have been fixed as follows: With current to work threshing machines, 1·80 marks for the first 20 morgen (acres), and every additional morgen 1·30 marks; without current for threshing purposes, 1·30 and 1 mark per morgen respectively. Twenty per cent. rebate is accorded to members taking current up to 1,000 marks. Forest land, waste and pasture are excluded.

In the Upper Swabian district of the same province two other co-operative electric societies are at work, and an agreement has recently been come to with one of them, the Herrenberger Elektricitätswerke, to supply the Hechingen district with power and light. This company already supplies 61 communes, its clients numbering 1,900, with 1,500 motors. The success of the operations of this co-operative venture is shown by the fact that it distributed in 1908 a dividend of 4½ per cent. on a capital of 1,600,000 marks (£80,000).

It is announced that the Berlin Electricity Works Co., which controls the supply of electric light and power in the German capital, has adopted coin meters by way of experiment. The price charged to consumers on this method is 6d. per KW.-hour, which appears to include rent of wiring and fittings.

ROUMANIA.—It is proposed to build a large central station at Bucharest, at an estimated cost of 1,855,000 fr. At the expiration of the tramway concession in 1916, the station will have to be enlarged, involving a further expenditure of 3,500,000 fr. The station will supply energy to the communal tramways and for the lighting of the external parts of the city, also for the refrigerating establishments, the artesian well plant and general industrial purposes. It is calculated that, from 1911 to 1916, 6,400,000 KW.-hours per year will be required, and from 1916, 30,000,000 KW.-hours. The KW.-hour will be supplied at from 14 to 15 centimes to the tramways and at 7 centimes to the water plant. Tenders will be invited for the construction of the station.

Croydon.—All the tramway routes except the main route are now lighted with Osram lamps, fixed on the trolley poles or on small arc lamp-posts; each lantern contains three 110-watt Osram lamps in spring-suspended lamp-holders, and is fixed with the reflector 20 ft. 3 in. from the ground, the distance apart being on the average 65 yards. Osram lamps are also much used for side street lighting in Croydon, a single 38-watt lamp with a conical reflector being fixed at a height of 12 ft., and at an average interval of 75 yards.

Dover.—The Admiralty, which is said to have an interest in the Dover Electricity Works to an amount approaching £150,000, some time since appointed an expert to investigate various matters in connection therewith. The report is now in the hands of the authorities. It is understood that the recommendations are of an extensive character, one of them being a suggestion for the amalgamation of the tramways and the electric light undertakings. A special meeting of the Town Council will shortly be held to consider the report.

Dowlais.—The tender of the Merthyr Electric Traction Co. has been accepted for public lighting.

Dundee.—The T.C. has agreed to insert a clause in the next prov. order to have the electricity department placed on the same basis in respect of taxation on the underground works as the other departments. It was stated that whereas the gas department received 75 per cent. reduction on their mains, the electricity department received, in few cases, only 25 per cent. reduction.

Acting upon the report of the engineer, the Electricity Committee has decided to return the old system of charging for lighting energy by meter, instead of by rental. An experiment had been tried in the lighting of a tenement during the past year, and charging by rental per lamp. It was found, however, that there was a waste of current, and in the opinion of the engineer, the meter system, with care, would be found cheaper than rental.

Eastleigh and Bishopstoke.—The 1904 E.L. order has been revoked.

Edinburgh.—A deputation appointed to visit other towns in connection with a proposal to erect cooling towers at the electric light stations, has submitted its report to the Corporation Electric Lighting Committee. It was represented that such a provision would probably enable a saving in the coal bill of something like 35 per cent., amounting in the case of Edinburgh to £3,500 per annum. The engineer and superintendent are to prepare sketches of the proposed towers, and to submit estimates of the probable cost of one or two such towers.

Glasgow.—Mr. Lackie, the engineer, has submitted to the Electricity Committee a report as to the rates charged for lighting and power purposes in the city, and it has been decided to continue consideration of the matter until after the termination of the current financial year, when it will be discussed along with the annual accounts of the department.

Gosport.—The street lighting question was again before the U.D.C. on March 10th, when terms were received from the gas and electric light companies. The latter offered to provide and maintain lamps of 120 C.P. each, at £4 5s. 3d. per annum, and lights of 300 C.P. each at £10 2s. 6d. per annum, the present gas standards being converted. The matter was referred to the Special Lighting Committee.

Greenock.—An interesting function took place recently when the new Westinghouse turbo-generator set at Dellingburn works was started. Up to the present only direct current has been supplied at Greenock, but the new plant is designed to supply H.T. alternating current, chiefly to the Government's new torpedo factory and Messrs. Scott's shipbuilding yard. In the course of some remarks, Provost McMillan said the Corporation's electricity department last year generated 3½ million units, and the present year showed an increase of one million units.

Hanley.—The T.C. has decided to supply electricity to the Cockshutt Sidings of the North Staffs. Railway Co. at a flat rate of 1d. per unit for lighting and power.

Harrow.—A fire occurred early on the 13th inst. at the station of the Harrow Electric Light & Power Co., the showroom and offices being burnt out and damage occurring to the extent of £1,500.

Heywood.—At a meeting of the T.C. held on the 10th inst., it was reported that the town clerk had received sanction from the B. of T. to borrow the sum of £2,708 for tramway purposes and £13,945 for electricity extensions, &c.

Hornsey.—A long discussion took place at the last meeting of the B.C. in regard to a proposal to transfer up to £1,000 from the electricity profits to the relief of the rates. In favour of the proposition, it was argued that the loss on the undertaking had been met out of the rates for some years, to the extent of £7,189. The chairman of the Electricity Committee said it would be a disastrous policy to cripple the undertaking, which had only an accumulated estimated balance of £1,075 up to March 31st. In the course of the subsequent discussion it was stated that probably the whole £1,000 would not be taken from the electricity profits. In the result it was agreed that the rates be relieved out of the profits of the electricity undertaking. An amendment that the amount taken should not exceed 50 per cent. was defeated.

India.—According to the *Indian and Eastern Engineer*, the Lighting Committee of the Calcutta Corporation has recommended that electricity should be used in some of the main thoroughfares of the city.

The Simla Municipal Committee has obtained a licence from the Punjab Government for the supply of electricity for street lighting and other purposes on the completion of the hydro-electric schemes.

The Punjab Government scheme for providing electric lift irrigation to 11,000 acres at Buchiana, on the Lower Chenab Canal, estimated to cost Rs. 1¼ lakhs, has received the approval of the Indian Government, subject to its further consideration in detail.

The Kolar Gold Field authorities have placed an order with the Lahmeyer Co. for an 800-H.P. three-phase, 3,300-volt, 25-cycle motor to operate a converted main steam winding engine. The Lahmeyer Co. has already supplied five 350-H.P. three-phase main winders to the Kolar goldfields.

Japan.—The Japanese Department of Communications has secured an appropriation from the Government of 200,000 yen (a yen = 4s. 2d.) for the purpose of investigating hydro-electric potentialities in Japan. The programme of the Department is to spend a sum of 1,250,000 yen during a period of five years on the investigation. It is estimated that there are in the whole Empire 55 main rivers offering facilities for hydro-electric development, and on the average each river has 10 tributaries. Thus the total number of streams to be investigated is 550, and allowing three power plants to each stream, no fewer than 1,650 stations will be required.

Baron Goto, the Minister of Communications, has announced in the Japanese Parliament that the Government will shortly introduce a Bill in the Diet for the control of electrical enterprises in Japan.

London.—MARYLEBONE.—The original estimate of the first street lighting scheme was £7,860 for 1,900 posts. The first revised estimate was £7,510, and the final estimate was £5,460, while the actual cost has now been ascertained to be £5,630. The general manager reports that he has never known service costs to come out so low as regards the actual value of the work carried out. The revenue account for the three months ending December shows that the total units sold were 3,852,130, as compared with 3,033,150 in the corresponding period of 1908. Of the increase, the public lighting scheme contributed 267,728, and private consumers 550,652. The latter was equivalent to an increase of 15·5 per cent., as against the estimate of 11·2 per cent. The average price obtained from private consumers was 4·072d. per unit, the corresponding figure in the previous year being 4·45d. The general manager says that this tendency to steady diminution of price is one of the most hopeful signs of success. The number of public lighting units is greater than the original estimate, owing to the decision to put in larger lamps in the more important thoroughfares; notwithstanding this, the average price obtained for this purpose (after allowing for maintenance and proportion of capital charges) is practically the same figure as that on which the scheme was adopted. The total income from sales (including meter rents) to private consumers amounted to £59,737, and for public lighting £3,127, being £4,427 and £2,539 respectively in advance of the corresponding period of the previous year. The expenditure figures were equally satisfactory. There was a reduction in the average cost per unit of ·214d., equal to a saving of 22 per cent. on last year's costs. This economy in working expenses largely accounts for the stronger financial position of the undertaking. The expenditure in connection with the sales department for the quarter amounted to £930, but this figure is reduced to £447 after crediting the gross profits on works completed during the quarter. The net cost of the old publicity department during the corresponding period in 1908 was £254. The expenditure during the past quarter, however, included sums amounting in the aggregate to £180 in connection with additions to the showroom, fitting of sales offices, &c. Taking all into consideration, the consumers' branch of the department may be said to have cost £143 net, as compared with the net debit of £254 for the December quarter, 1908. The manager believes that the time is rapidly approaching when this branch of the work will fully pay for itself out of the profits on the sales of apparatus and works on the consumers' premises, quite apart from the very material benefit derived from the permanent additions to the consumers' roll. During January, 71 applications for installations were received, 25 from the sales department and 43 from contractors and other trades. In January, 1909, there were 50 installations, five of which were put in by the old publicity department and the remaining 45 by contractors and other trades. It will thus be seen that while the work of the department has increased, the contractors are doing as much work as they were before the department commenced operations. The general manager is to proceed with the work of extending mains for street lighting and other purposes as soon as possible.

HACKNEY.—The Electricity Committee has reaffirmed the offers made in May last to the Bethnal Green B.C. for the supply of energy to that borough.

Macclesfield.—The 1901 E.L. order has been revoked.

Mexico.—According to American information the Guanajuato Power Co. and the Chapala Hydro-electric and Irrigation Co., whose plants are 150 miles apart, have, owing to the extension of their transmission lines and consequent clashing of business interests, come to a mutual agreement for division of business. Under this the former company is to make two transmission extensions of 110 and 190 miles to supply 10,000 and 6,000 H.P. respectively to the cities of Aguas-Calientes and Zacatecas, and to join up its system to that of its rival. The agreement also fixes the selling prices of energy.

The A. B. Adams Co., of Mexico City, has made plans for a 60,000-H.P. plant on the Balsas River, near Guerrero.

Monaghan.—At the monthly meeting of the Council on the 8th inst., the question of the lighting of the town came up on a motion that the Council adopt a scheme for the lighting of the town by electricity. About a fortnight ago a public meeting was held, at which it was agreed that such a scheme should be put in operation. After much discussion a committee was appointed to wait on the directors of the gas company and discuss the purchase of the gas concern, and also to wait on Mr. W. A. M'Caldin and obtain particulars from him as to the terms on which he could supply electric light to the town.

Norwich.—The T.C. has applied to the L.G.B. for a loan of £17,783 for mains, services, exhaust steam turbine with condenser, steam, exhaust, water pipes, &c., coal elevator, feed-water filter, &c.

Penzance.—The proposed revocation by the B. of T. of the Penzance Electric Lighting Order, 1904 (owing to the failure of the Penzance District Electric Supply Co. to carry out a scheme), has been referred to the Electricity Committee.

Ramsbottom.—The Lancashire Electric Power Co. has made definite arrangements to supply electricity to Ramsbottom. A site for the sub-station has been chosen, and the building is to be ready by the end of May. Meanwhile, the company intends to proceed with the laying of the cables. It is anticipated that a supply will be available by August 1st next.

South Africa.—DURBAN.—We extract the following from the detailed report for the year ended July 31st, 1909, of the borough electrical engineer, Mr. J. Roberts. Mr. Roberts reports further progress with the electricity undertaking by which the works cost has been brought down to 1·13d. per unit sold, the total cost being 1·96d. The number of units sold was as follows:—Private lighting, 1,504,561; motive power, 1,643,882; public lighting, 700,000; tramways, 2,614,367; total, 6,462,810. The total revenue amounted to £69,321, from which a net profit of £16,038 was derived; the average price obtained per unit was 2·56d. The cost for private lighting has been reduced from 8d. to 7d., which, with a 10 per cent. discount for prompt cash, brings it to 6·3d. Considerable economies have been effected during the year by the erection of a cooling tower of the borough electrical engineer's design, and also by the installation of a steam turbine supplying both A.C. and D.C. during the hours of light load, the capacity being 750 KW. on the D.C. and 250 KW. on the A.C. A scheme of assisted wiring has lately been brought into vogue, which enables all classes to adopt electric lighting. The growth of the department is shown in the following table:—

	1908.	1909.
No. of electric light consumers...	3,931	4,148
No. of motive power consumers	246	263
No. of arc lamps	275	278
No. of incandescent street lamps	1,575	1,772
Length of overhead mains, miles	103·6	114·6
Length of underground mains...	117	120·75

CAPE TOWN.—The accounts of the Cape Town Electric Lighting Works for the year ending December 31st, 1909, show a total revenue of £56,097, and a gross profit of £24,077, which was disposed of as follows:—Interest and loan charges, £13,319; depreciation, £8,304; and contribution to rates, £2,454.

Southampton.—Electric light is to be substituted for gas in the whole of the schools at an estimated cost for wiring of £804. The Works Committee has passed a scheme for the conversion of 596 additional gas lamps to electric light; 433 gas lamps were converted last year.

Tavistock.—A public meeting was held on Monday evening, to discuss the desirability of obtaining powers for lighting the town and district by electricity. Mr. A. Barnes, of Drake and Gorham, Westminster, was present to answer any questions. Mr. E. L. Spooner, in advocating electric lighting by the U.D.C., argued that the amount they could save in street lighting would go a long way towards paying interest on the capital required by the town for providing an installation, &c., and that in proportion to the sale of energy to the public the rates of Tavistock would be lessened. An amendment that the meeting recommend the Urban Council to let the electric lighting of the town be undertaken by private enterprise was carried by a large majority.

Torquay.—The T.C. has appointed a Committee to prepare an estimate of the cost of renting and fitting up a shop as a showroom for the display of electrical fittings and appliances, and to report on the advisability of the Council embarking upon such a scheme.

Tottenham.—At the meeting of the Metropolitan Asylums Board on Saturday, the Engineer-in-Chief reported that the contract for the installation of electricity at the North-Eastern Hospital had been satisfactorily completed at a total cost of £5,037. It was decided, subject to the sanction of the L.G.B., to award a gratuity of £25 to the clerk of works.

Walsall.—The Electricity Committee of the T.C. has recommended the withdrawal for the present of the application for a loan of £35,000 for an electricity scheme, and the substitution of an application for a loan of £8,345 for a sub-station and mains, coal elevator, transformer for sub-station, and mains and services for three years.

Wednesbury.—A L.G.B. inquiry was held on March 11th into the application of the T.C. for a loan of £2,095 for electricity purposes, £1,750 being for prospective expenditure on small mains, extension services, and meters, for two years, and £345 in respect of expenditure incurred on meters and mains up to March 31st, 1909. Mr. H. R. Hooper, the inspector, mentioned that in April, 1907, he informed the Council that all meters must be charged to revenue, and it was replied that the Committee would accept the suggestion. Mr. Hooper advised the Council to increase the loan asked for to £2,925, so as to avoid the necessity of another loan in one or two years' time, and this course was adopted.

West Ham.—The electrical engineer has been in communication with the Anglo-Continental Guano Works Co., Ltd., of Silvertown, with a view to the company obtaining their whole supply of current from the works. Provisional terms for a new agreement have been arranged. Application is to be made to the L.G.B. for sanction to borrow £55,000 to meet the additional capital expenditure in connection with the electricity undertaking for the next two years.

Whitwood (Yorks).—The U.D.C. has arranged a draft agreement for electricity supply with the Power Co.; the Council has also decided to invite tenders for carrying out the scheme.

Wolverhampton.—£1,417 is to be transferred from the profits of the electricity undertaking for the year ending March 31st, 1910, to the credit of the improvement fund.

TRAMWAY and RAILWAY NOTES.

Ashton-under-Lyne.—On the initiative of the Ashton-under-Lyne Corporation a conference will shortly be arranged with several other local authorities concerned in regard to a proposal to take over the Oldham, Ashton and Hyde Electric Tramways, which are the property of the British Electric Traction Co. The lease of the tramway undertaking expires in 1917, and then the local authorities through whose areas the tramways pass will have the option of purchase. The authorities interested are Ashton-under-Lyne, Denton, Audenshaw, Waterloo and Bardsley.

Belfast.—A special meeting of the Corporation was held on the 10th inst., to consider the question of promoting a Bill in Parliament to confirm an agreement between the Cavehill and Whitewell Tramway Co. and the Corporation for the purchase of its undertaking at a price to be fixed by an arbitrator, and to wind up the company, &c. When the last purchase scheme was being discussed the sum of £60,000 was spoken of as the purchase money. It is understood that in any case should the Corporation purchase the undertaking the track will have to be doubled, as it is only a looped line at present. Should the negotiations fall through, it is believed that the company will proceed with a Bill to obtain running powers into Belfast over the Corporation's lines.

Bradford.—The opposition of the Yorkshire (Woollen District) Electric Tramways, Ltd., to the Bradford Corporation Bill has been withdrawn.

Brazil.—With reference to the proposed extension and electrification of the Victoria-Diamantina Railway, H.M. Consul-General at Rio de Janeiro reported, under date January 31st, that "definitive studies" were to be begun at once from the Barra do Rio Santo Antonio, on the River Doce, to Itabira do Matto Dentro, and from Itabira to Santa Anna dos Ferros, a total distance of about 186 miles. It was hoped to complete these surveys within a very short time.—*Board of Trade Journal.*

Canada.—A company has been organised to build a railway from Queenstown to Niagara, some 7 miles, at a cost of $50,000. Mr. G. H. Pettit is the solicitor to the company.

The ratepayers of Sherbrooke, Quebec, are to vote on a by-law connected with street railway extensions. The Sherbrooke Electric Railway and Power Co., of Montreal, has applied for permission to supply electricity, and has practically agreed to spend $500,000 on power plant, &c.—*Canadian Engineer.*

Cardiff.—The Tramways Committee on Friday last week received a report from Mr. Arthur Ellis on the tramway returns since the alteration of fares came into force. The January returns showed in comparison with last year an increased revenue of £501, and increased passengers 14,858, while the mileage decreased by 3,763 miles. The total increased receipts to January 31st were £2,261. The February receipts similarly showed an increase of £620, and the passengers an increase of 56,068, while the mileage was decreased by 4,508 miles; the March figures were even better. If the improvement continues, Mr. Ellis considers that the revenue will show an increase of £4,000 on the year.

Continental Notes.—Austria-Hungary.—It is reported from Buda-Pesth that an electrical company has been ordered by the authorities to entirely demolish a new power station which had been nearly completed at considerable expenditure near the city in connection with the electric railway between Buda-Pesth, Waitzen and Godollo. It appears that the station had been built on marshy land, on foundations which, in the opinion of the authorities, were insufficiently deep to the extent of 3 ft. 4 in.

Plans are being prepared in respect of a projected electric railway between Linz and Engers-Bendorf.

Germany.—It was recently reported that the new Edison battery was to be introduced on the accumulator cars used on various sections of the Prussian State Railways. In interested circles in Germany, however, it is now stated that merely a trial coach with this equipment has been placed at the disposal of a private railway, and that the car has only been in use for such a short time that an opinion cannot yet be formed of the serviceability of the Edison accumulator. The high price of the iron-nickel battery also stands in the way of its employment for railway cars.

A proposal to establish a rail-less electric vehicle service on the Mercedes-Stoll system between Ludwigsburg and Aldingen, Wurtemburg, is at present under consideration.

Holland.—The Communal authorities of Breda have under consideration the granting of a concession for an electric tramway in the town to Messrs. Jhr. Presse & Co.

Russia.—Plans are being prepared in respect of a projected electric tramway between Savastopol and Yalta.

Belgium.—La Socié é des Tramways Electriques de Peruwelz et Extensions is the name of a new company, which has just been formed in Brussels with a capital of £40,000 to construct a system of electric tramways in the Peruwelz district.

Turkey.—Application has been made to the Ministry of Public Works for a concession to establish an electric tramway service in Beyrouth, Palestine.

The city of Drussa will shortly be in possession of an electric tramway system, the concession asked for by Dr. Javanovich, of Smyrna, having been accorded. The concession is for a term of 70 years, and the line will have a length of 8 km.

Edinburgh.—The Corporation Tramway Committee recommends the acceptance of an estimate amounting to £12,265 for the construction of an electric line connecting the present cable tramways with the new markets at Gorgie. The contractors are Messrs. Dick, Kerr & Co., and the contract is to be finished by May 14th. This marks the beginning of electric traction in the city.

Fife.—It is believed that the Dunfermline and District Tramway Co. intend to carry through the Kelty and Lochore branch of their system, and to extend to the Rumblingwell district during the summer.

Liverpool.—The report of the general manager, Mr. C. W. Mallins, on the working of the Corporation tramways for the year 1909, shows a gross revenue of £592,721, and an operating cost, including rental of leased lines, of £400,205. The gross profit was apportioned as follows:—Interest, £50,919; sinking fund, &c., £59,249; reserve renewals, &c., £54,902; contribution to rates, £27,451. The net profit for the year, £82,354, showed an increase of £7,779 on the previous 12 months. The passengers carried during the year numbered 121,532,940, and the car-mileage was 11,952,373, the average receipts being 11·27d. per car-mile. Penny tickets accounted for nearly 90 per cent. of the receipts. The intersectional traffic statistics at Liverpool are always interesting. During the busy season 5,882 cars per day arrive at and leave the Pierhead, while at five other points on the system the daily cars number from 4,000 to 3,280.

South Africa.—The report of the manager of the Durban tramways for the last year's working contains the following particulars:—Length of track in operation, 30½ miles; total income, £94,114; operating expenses, £55,916; net income, £38,198; car-miles, 1,364,772; passengers carried, 13,301,060; passengers carried per car-mile, 9·74; average fare per passenger, 1·66d.; traffic receipts per car-mile, 10·33d.; units used, 2,556,186; price per unit, 1·225d.; units per car-mile, 1·88.

Southport.—As a sequel to the fatality which recently occurred during the use of a horse tower wagon while repairing the overhead wires of the tramway system, the Electricity Committee on Wednesday last submitted a proposal that a motor-wagon be purchased at a cost of £475. Strong opposition was forthcoming, but the motion was adopted by 16 votes to 14.

Wigan.—Important developments are likely to take place in connection with the extensive electric tramway undertaking belonging to the Corporation, whose system serves the majority of the populous townships in this Lancashire Union area. Overtures are being made by the Lancashire United Tramways Co. for the purchase of the whole concern, and though no definite proposal has been made to the Corporation, a meeting of the General Purposes Committee of the Council was held on Friday, March 11th, specially to consider whether the Council would be likely to negotiate. The meeting was held *in camera*, and no official announcement has since been made, but we understand that so far as the committee is concerned, the idea of selling was scouted, the voting being 36 in favour of a resolution declining to consider the offer, and six for ascertaining the approximate terms and conditions. The general manager of the Lancashire United Tramways Co. afterwards made a statement, pointing out that the Corporation had all along been losing on the undertaking, and the Hon. A. Stanley, M.P., had instructed him to make an offer to take it over. There were many ways in which economies could be effected, which, perhaps, a municipal body could not carry out. The tramways, it was suggested, could be worked in conjunction with the Lancashire United Tramways, and in that respect, for instance, an economy would be effected in running the two systems from one power station. As far as the present Corporation electricity works were concerned, they would

in a sense, scrap everything and start with a fresh scheme, the tramways to be controlled by an entirely new company, a different entity from the Lancashire United. The Hon. A. Stanley, who is greatly interested in the Lancashire United Tramways Co., is the moving spirit in the matter, and it is not likely that the decision of the General Purposes Committee has closed the project.

TELEGRAPH and TELEPHONE NOTES.

Cable Repaired.—Tourane-Amoy, March 15th, 1910.

Durban Telephones.—For the year ending July 31st, 1909, the total revenue amounted to £13,978; the expenditure was £12,837; the total calls numbered 4,045,525; and the average calls per subscriber per day, 9·1; the subscribers numbered 1,265.

Wireless Telegraphy.—The German Colonial Co., of Berlin, announces that as the result of the preliminary trials made in connection with the proposal to establish a direct system of wireless telegraphy between the Nauen station, near Berlin, and the German Cameroons, it is considered that such a system can be instituted between the two points, which are 3,410 miles apart, provided that a station of the same size as that at Nauen is erected in the Colony, and that no high and wooded mountains are situated in the immediate neighbourhood of the station.

It is reported that H.M.S. *Dreadnought*, now being refitted at Portsmouth, will be equipped with a new wireless installation of such power, that she will be able to speak from Portsmouth to Malta, under favourable conditions, and to Whitehall from any part of the home waters.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—April 9th. Generating station building, plant, battery, cables, &c, for the U.D.C. See "Official Notices" to-day.

Australia.—Tasmania.—Material for accumulator equipment, for the P.M.G. See "Official Notices" March 4th.

April 18th.—Electrically-driven pumping machinery for No. 1 sewerage pumping station, Newcastle, N.S.W., for the Public Works Department, Sydney.

April 27th.—200 tubular iron or steel poles, for the P.M.G.'s Department in South Australia. Forms, &c., at the Commonwealth Office, London.

Bedford.—March 28th. One 750-kw. steam-driven single-phase alternator and exciter. See "Official Notices" to-day.

Belgium.—March 23rd. La Société Nationale des Chemins de Fer Vicinaux, of 14, Rue de la Science, Brussels, are inviting tenders for the supply and laying of the armoured underground electric cables required at La Louviere in connection with the local electric railways in the Centre district. A copy of the specification and of the plans can be obtained from the address on payment of 1 fr. and 3 fr. respectively.

Bolton.—March 31st. Materials and stores for the Electricity Department. See "Official Notices" March 11th.

Canada.—April 15th. Proposals are invited for an installation of electric light and power plant, on a 10 years' franchise basis, for the town of Camrose, Alta. Companies or individuals will be treated with. Mr. O. B. Olson, secretary-treasurer, will furnish particulars and receive tenders.

Chichester.—March 22nd. E.L. sundries for the West Sussex County Asylum for a year. J. R. Newman, clerk and steward.

Colwyn Bay.—April 9th. Stores for the U.D.C. Electricity Department. See "Official Notices" to-day.

Dudley.—March 22nd. Electrical sundries for the B.G. for six months. G. W. Coster, clerk, Union Offices.

Dundee.—Small coal, general stores and meters, for the Electricity Department, also offers for the insurance of the boilers at the Carolina Port generating station. Mr. H. Richardson, engineer.

Felixstowe and Walton.—Steel boiler drum, oil cart and set of switchgear and cable connections, for the U.D.C. See "Official Notices" March 4th.

Germany.—The municipal authorities of Hassfurth (Unterfranken) are about to invite tenders for the establishment of a central electric lighting station in the town.

Glasgow.—March 22nd. 20,000 car lamps, for the Corporation. See "Official Notices" March 4th.

March 29th.—Main cables, meters and arc lamp carbons for the Corporation. See "Official Notices" March 11th.

Gloucester.—April 2nd. Electric lighting of the Shire Hall extensions. See "Official Notices" March 11th.

Grimsby.—March 21st. 300 cast-iron lamp-posts, swan necks and D.P. fuse boxes, for the Corporation. See "Official Notices" March 4th.

Hackney.—April 7th. Flame lamp carbons for the Electricity Department. See "Official Notices" to-day.

Halifax.—March 22nd. Electrical fittings for six months for the B.G. A. T. Longbotham, clerk, 4, Carlton Street.

Huddersfield.—March 31st. 1,000 single-phase A.C. meters for the Borough Electricity Department. See "Official Notices" to-day.

Hungary.—The municipal authorities of Kisujszalli have just invited tenders for the establishment of a central electric lighting station in the town.

Limerick.—March 25th. Annual supplies for the B.C. Electricity Department. See "Official Notices" March 11th.

Liverpool.—March 22nd. Supplies for a year, for the West Derby Board of Guardians. H. P. Cleaver, clerk, Brougham Terrace.

London.—March 23rd. Wiring and fittings for the electric lighting at the Camden Street Central School. See "Official Notices" March 4th.

Salford.—March 28th. Motor tower wagon for the T.C. General Manager of the Tramways.

March 31st.—Electric wiring of the Wellington Street Boys' Council School, Pendleton. See "OfficialNotices" March 11th.

Spain.—May 8th. The Spanish Ministry of Public Works, in Madrid, is inviting tenders for the construction and working of an electric tramway between the Rue Velasquez and the Rue de Diego de Lion.

The municipal authorities of Vilatorta (province of Barcelona) have just invited tenders for the concession for the electric lighting of the town during a period of 9½ years.

Wallasey.—April 18th. Stores, for the U.D.C. Electricity Department. See "Official Notices" to-day.

Warrington.—March 22nd. 1,000-kw. turbo-alternator, 750-kw. rotary converter and switchgear, for the Corporation. See "Official Notices" March 4th.

Wigan.—March 21st. Electrical and tramway stores, for the T.C. J. Slevin, Electrical Engineer and Tramways Manager, Bradford Place.

Wolverhampton.—March 30th. One 2,000-kw. turbo-alternator and one 500-kw. mixed pressure turbo-alternator, for the Borough Electricity Department. See "Official Notices" to-day.

CLOSED.

Australia.—From an Australian contemporary (*Australian Mining and Engineering Review*) we glean the following items regarding recently placed electrical contracts:—

For P.M.G., Victoria.—
Electrical material.—Lawrence & Hanson, £215.
Telephone conduits.—Mills & Co., Brunswick, £1,054.
Earthenware conduits.—G. Sweet, £3,721.
Galvanised iron pipe.—Stewarts & Lloyds, Ltd., £614.
Switchboard cable for telephone exchanges.—Western Electric Co., Ltd., £143 and £621.

For P.M.G., New South Wales.—
Six nauts. submarine telegraph and telephone cable.—W. T. Henley's Telegraph Works.
One hundred telephones.—Western Electric Co.
Galvanised iron-wire.—R. Johnson, Clapham & Morris.

South Australia.—
9,050 telephones.—Ericsson & Co., Sweden (per agents), £23,676.

Another contemporary (the *Australasian Hardware and Machinery*) mentions the recent placing of the following contracts:—

Complete new equipment of the Hawthorn Telephone Exchange, Victoria.—General Electric Co. (per Lawrence & Hanson), £14,317.

Cable for the P.M.G., Queensland.—B.I. and Helsby Cables, £108.

Telegraph, telephone and electric light material for 1909-10, for the P.M.G., New South Wales.—Union Cable Co., one item; W. T. Henley's, 7 items; Western Electric Co., 87 items; India-Rubber, Gutta-Percha and Telegraph Works, 3 items; Lawrence & Hanson, 7 items; J. T. Jay, 1 item.

Messrs. J. Hopkinson & Co., of Huddersfield, are engaged upon a large order for steam fittings for the power house of the Municipal Tramways Trust, Adelaide.

The Municipal Tramways Trust has given an order for three 1,500-kw. turbo-alternators, condensers, motor-driven auxiliaries, cranes, &c., to Messrs. C. A. Parsons & Co., Ltd.

Canada.—St. Thomas, Ont.—According to a Canadian exchange, the tender of the Canadian Westinghouse Co. to supply and install complete hydro-electric equipment at $18,170 was accepted. Only three companies tendered for the full equipment. These were:—

Canadian General Electric Co.	$19,050
Lancashire Dynamo and Motor Co.	18,447
Canadian Westinghouse Co.	18,170

Cotton Mills.—The Rochdale Electric Co., Ltd., have secured the electric driving contract, including generator and motor equipment, for the new weaving shed now being built by Messrs. A. Holroyd & Co., of Rakewood Mill.

East Ham.—The T.C. has accepted the tender of J. Baker & Co., Ltd., for wrought-iron centre wheels for tramway cars, at £3 18s. per wheel; and of Hadfield's Foundry Co. for cast-steel centre wheels, at £3 17s. per wheel.

Glasgow.—The T.C.'s Electricity Sub-Committee on Works has recommended for acceptance, an offer, at £780 by the British Westinghouse Co., for providing and fitting up one rotary converter for transforming electrical energy at the locomotive works of the Caledonian Railway Co.

India.—Messrs. Siemens Bros. Dynamo Works, Ltd., of Dalston, have obtained a large contract for street lighting fittings for a municipality in an Indian State.

London.—L.C.C.—The Stores and Contracts Committee recommends the acceptance of the tender of the Edison & Swan United Electric Light Co. for electric insulating materials to December 31st, 1910 (estimated value £125).

Marylebone.—The B.C. has accepted tenders for cable from Messrs Aubert Grenier & Co. and the Standard Cable Manufacturing Co. For cut-outs, house service and disconnecting boxes, tenders have been accepted from Lucy & Co., Ltd.; Consolidated Electric Works and Appliances, Ltd.; Callender's Cable and Construction Co., Ltd.; Sykes & Sugden, Ltd.; and British Insulated and Helsby Cables, Ltd.

A large contract for tantalum lamps for all voltages from 25 to 250 has been placed with Siemens Bros. Dynamo Works, Ltd., by the General Post Office; also one for tantalum lamps for station and sign lighting on the Metropolitan Railway.

Fulham.—The B.C. Electricity Committee recommends that contracts be entered into with the following:—

Electrical goods.—Siemens Bros. Dynamo Works, Saxonia Electric Co., Sunbeam Lamp Co., British Westinghouse Co., Veritys, Ltd., India-Rubber, &c., Co., General Electric Co., Siemens Bros. & Co., Davis Electric Co., B.I. and Helsby Cables, Ltd.
Frames and covers.—W. T. Henley's Telegraph Works Co., W. Lucy and Co., Sykes & Sugden.
House cut-outs, &c.—B.I. and Helsby Cables, Sykes & Sugden and W. T. Henley's Telegraph Works Co.
Copper brushes, &c.—Chaplin Bros.
Carbon brushes.—Le Carbone.
Carbons.—Andrew & Suter and Birmingham Carbon Works.

Portsmouth.—The Corporation Tramways Committee has accepted tenders for car repairs stores as follows:—

Dick, Kerr & Co., Ltd.; Estler Bros.; A. Wiseman; Tramways Supplies Co.; Pryke & Palmer; Watlington & Co.; West Bromwich Spring Co.; S. Cook & Co.; London Transfer Depôt Co.; F. Bird & Co.; and Magnolia Metal Co.

Tenders for electrical and insulating materials have been accepted as follows:—

Whiteley Bros.; Dick, Kerr & Co.; Watlington & Co.; D. Jaroslaw; Spicer Bros.; India-Rubber Gutta-Percha and Telegraph Works Co.; W. H. Keys; British Electric Manufacturing Co.; General Electric Co.; Pryke and Palmer; and British Thomson-Houston Co.

The Committee has accepted tenders for overhead line materials as follows:—

Watlington & Co.; Imeson Finch & Co.; British Insulated and Helsby Cables, Ltd.; Estler Bros.; and W. B. Brown & Co.

The Committee has further accepted tenders for castings as follows:—

The Steel Nut and Joseph Hampton, Ltd.; Malleable Steel Castings Co.; A. Wiseman, Ltd.; Babcock & Wilcox; Parker Foundry Co.; W. H. Sperring & Co.; and H. and W. Davis.

Plymouth.—The T.C. has accepted the following tenders for annual supplies for the electricity undertaking:—

British Insulated and Helsby Cables, Ltd.—Cables, £93 (last year's price, £114).
Crompton & Co., Ltd.—Carbons, Conradty C., £3 16s. 6d. per 1,000 ft., (last year's price, £3 17s. 6d.).
Ferranti, Ltd.—House meters.
British Electric Transformer Co.—Transformers, average per kw., £1 14s. 5½d. (last year's prices, £1 17s. and £1 17s. 1d.).
The tender has also been accepted of Walter Scott, Ltd., for 100 tons of tram rails, joint and anchor plates, at £8 per ton, and fishplates, £10 per ton.

South America.—Messrs. Siemens Bros., of Dalston, London, N.E., have obtained a very large contract for street-lighting fittings of special design for a district in South America.

Southport.—The Corporation Tramways Committee has accepted the tender of the Leyland Motor Co., for a motor tower wagon, at £475.

Stalybridge.—The Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board has placed a repeat order with Messrs. Ed. Bennis & Co., Ltd., Little Hulton, for four stokers and compressed-air furnaces (Lancashire boilers), for the generating station, Tame Valley.

Sutton Coldfield.—The T.C. has accepted the tender of Callender's Cable Co., Ltd., for the extension of mains to Wylde Green, at £3,419.

Whitehaven.—The T.C. has accepted the following tenders for annual supplies:—

Callender's Cable and Construction Co., Ltd.—Bitumen.
British Thomson-Houston Co., Ltd.—Carbon-filament electric lamps and 10 and 25-ampere meters.
Edison & Swan United Electric Light Co., Ltd.; Siemens Bros. Dynamo Works, Ltd.—Metallic-filament electric lamps.
Geipel & Co.—Okonite rubber and Zokerite tape.
British Insulated and Helsby Cables, Ltd.—Fuse boxes.

Wh tehaven and Falkirk.—The tenders of the Bastian Meter Co., Ltd., for 5-amp. meters for these two towns have been accepted.

FORTHCOMING EVENTS.

Northampton Institute Engineering Society.—Friday, March 18th. At 6 p.m. Paper on "The Development of High Temperatures," by Mr. S. Field. Saturday, March 19th. Visit to the National Physical Laboratory.

Royal Institution.—Saturday, March 19th. At 3 p.m. Lecture on "Electric Waves and the Electromagnetic Theory of Light," by Prof. Sir J. J. Thomson. (Lecture VI.)

Junior Institution of Engineers.—Saturday, March 19th. At 3 p.m. Visit to the new engineering laboratory, workshops, &c., of the Finsbury Technical College.

North-East Coast Institution of Engineers and Shipbuilders.—Monday, March 21st. At 7.30 p.m. At the Lit. and Phil. Society, Newcastle-on-Tyne. Paper on "A Heat Diagram for use in Steam Turbine Design," by Mr. J. Morrow.

Institution of Electrical Engineers (Manchester Local Section).—Tuesday, March 22nd. At 7.30 p.m. At the University, Manchester. Annual general meeting. Paper on "Some Properties of Switch and Transformer Oils," by Messrs W. Pollard Digby and D. B. Mills.

Institution of Civil Engineers.—Wednesday, March 23rd. Students' visit to the West India and Millwall Docks, Grain Handling Equipment, &c.

Association of Engineers-in-Charge.—Saturday March 26th. Annual dinner.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are announced:—

Commanding Officer—Col. R. E. B. Crompton, C.B.

Monday, March 21st.—"A" Company. Recruits' infantry drill, 6 to 7 p.m.; technical drill, 7 to 9.30 p.m.
Tuesday, March 22nd.—"B" Company. Technical drill, 7 to 9.30 p.m.
Wednesday, March 23rd.—Gymnasium, 6.30 to 9.30 p.m.
Thursday, March 24th.—"C" Company. Technical drill, 7 to 9.30 p.m.
Friday, March 25th and Saturday, March 26th.—Headquarters closed.

(Signed) P. H. Campbell, Capt. R.E., Adjutant.
For O.C. E.E., L.D.

NOTES.

Easter Holidays.—The next issue of the Electrical Review, as usual in Good Friday week, will be published two days earlier, namely, Wednesday, March 23rd. Will our friends kindly take note of the following arrangements:—

The very latest time for the receipt at these offices of *Correspondence*, intended for publication in that issue, is 10 a.m. Monday, March 21st. *Notes and News matter* should reach us in the course of the same day, though late news of special interest will be welcomed up to early on the morning of Tuesday, March 22nd.

Our *Advertisement Department* announces the following arrangements:—*New copy* and alterations to existing displayed advertisements should be received not later than Saturday morning, March 19th (to-morrow). *Official Announcements and Prepaid Advertisements* can be received up to 9.30 a.m. on Tuesday, March 22nd.

Inquiry.—A correspondent asks whether the Boehm train-lighting system, described in our issue of June 17th, 1904, is still on the market.

Institution and Lecture Notes.—Metropolitan Association of Electric Tramway Managers.—A meeting of this Association was held on Thursday, March 10th, at the Municipal and County Club, Whitehall, S.W., those attending being:—Messrs. H. E. Blain (West Ham), A. G. Balfour (Dartford), J. K. Bruce (L.C.C.), A. Coveney (Erith), W. E. Hammond (Metropolitan Electric), H. L. Howard (Barking), C. Mittelhausen (Bexley Heath), W. Murray (Walthamstow), W. C. Ullmann (East Ham), G. E. Cummings (representing Sir Clifton Robinson, chairman of the Association), and T. B. Goodyer (Croydon), hon. secretary.

Mr. A. H. Stanley, general manager, London Underground Railways, and managing director of the London United Tramways, Ltd., was also present. During the temporary absence abroad of Sir Clifton Robinson, Mr. H. E. Blain (ex-chairman) was elected acting-chairman. Mr. Stanley was elected a member of the Association. The hon. secretary submitted various communications having reference to Metropolitan tramway matters, and also communications which he had received from America on the question of claims. The various topics were discussed, and the last named was referred to the acting-chairman and hon. secretary for further information to be obtained.

Royal Institution of Great Britain.—Among other announcements for Friday evening meetings after Easter, are the following:—

April 22nd.—At 9 p.m. Mr. T. Thorne Baker, F.C.S., A.I.E.E., "The Telegraphy of Photographs, Wireless and by Wire."

May 13th.—Prof. W. H. Bragg, M.A., F.R.S., "Radioactivity as a Kinetic Theory of a Fourth State of Matter."

Other arrangements are:—"The Constitution and Internal Structure of Alloys," by Mr. Walter Rosenhain, D.Sc. Two Lectures, on Thursdays, May 19th and 26th, at 3 o'clock.

"Electric Heating and Pyrometry," by Prof. J. A. Fleming, F.R.S. (The Tyndall Lectures.) Two Lectures, on Saturdays, June 4th and 11th, at 3 o'clock.

Annual Dinners. — The employés of Messrs. Rawlings Bros., Ltd., of Kensington and Belgravia, held their annual dinner on Saturday last at the Horseshoe Hotel, Tottenham Court Road, Mr. E. G. Nicholson, the works manager, being in the chair. After the toast of "The King" the toasts were restricted to two. "The Firm" was proposed by Mr. F. B. Howard, and Mr. W. R. Rawlings, one of the managing directors, responded. The firm still progressed and was able to show very satisfactory trading results despite the general depression. Most remarkable, perhaps, was the extraordinary growth of the motor garage department, and the success of the company's motor maintenance scheme. The chairman next proposed the health of "The Visitors," Mr. C. B. Price responding. The gathering recorded their appreciation of the efforts of the committee and the secretary, Mr. J. Green. The employés contributed a number of items to the musical programme.

The third annual dinner of the staff and employés of the Bolton Corporation Electricity Works was held at the Halliwell Lodge Hotel a few days ago. After dinner the gathering was presided over by Mr. B. S. Hornby (chief assistant engineer), and supporting him were Mr. W. J. Wood (station superintendent), Ald. J. Berry, J.P. (chairman, Electricity Committee), and Messrs. A. G. Livesey, R. Gregory, H. E. Annett and others. After the loyal toast, Ald. Berry gave the toast of "The Bolton Corporation Electricity Department," and said that the station contained 12 engines of over 12,000 H.P., and when the boiler extension was completed they would then have 18 boilers. He considered it was a cheap station, not as some might call cheap, the lowest price, but the lowest-priced article was not always the cheapest. Further, he was glad to say that all the machinery was British made. He referred to the unavoidable absence of Mr. Day, but was glad to say that he was improving. Mr. Hornby replied on behalf of the department. During the year their maximum load and output had both increased in spite of bad trade and the economies obtained by consumers in using metal-filament lamps. "Our Chief," "Our Visitors," and other toasts followed.

The annual staff dinner of the South Metropolitan Electric Light and Power Co., Ltd., was held at the Trafalgar Hotel, Greenwich, on Thursday, 10th inst. Mr. H. W. Bowden presided.

Prize Essay.—The James Prescott Joule Commemorative Medal for 1910 will be awarded in September next for the best essay dealing with Physical Science or Engineering. The competition is confined, for the present year, to past and present students of the Manchester Municipal School of Technology, the Principal of which will furnish particulars on application.

Dinner Announcement.—The annual dinner of Past and Present Engineering Students of University College, London, will take place at the Trocadero Restaurant, Shaftesbury Avenue, London, W.C., at 7.30 p.m., on Tuesday, 22nd inst. Tickets for the dinner, over which Sir Alexander B. W. Kennedy, Emeritus Professor of Engineering, will preside, can be obtained from the Secretary of the Engineering Society, University College, Gower Street, W.C. It is hoped that a large number of past and present students will attend.

Electric v. Hydraulic Lifts.—Addressing the meeting of the General Hydraulic Power Co., Ltd., recently, the chairman, Mr. W. T. Western, said that the competition of electrical energy continued, but had only succeeded in taking from them 20 machines out of over 6,000, and those 20 were mostly old machines installed at a time when the capabilities of hydraulic lifts for high speed and economy were not so well understood as at present.

Football.—On Wednesday last a football match took place at Herne Hill between the Southern and Northern Substations of the L.C.C. Tramways, and, after an exciting and well-fought game, the result was a win for the Southern Section by 3 goals to nil. In the evening the South entertained the North to a smoking concert at the Southern Club's headquarters, and the programme provided was greatly appreciated by a large and representative audience. This is the second season of the Southern Club.

Fire at Whiteley's.—A fire at Whiteley's, on Monday last, was checked by sprinklers and subdued without much loss. The official report stated that the cause was unknown, and out of half-a-dozen newspaper reports before us, four offer no explanation. The *Daily News* and the *Financier*, however, gratuitously insert the usual fused electric wire. The rule seems to be, "When in doubt, blame electricity."

Brunswick Mill Installation.—Correcting the correction in our last issue (page 377), in which we stated that this installation was "carried out to the requirements of the consulting engineers," The Bannerman Mills Co., Ltd., write us stating that the paragraph "is calculated to convey an erroneous impression, in that it infers that the installation as now running is throughout to the designs and requirements of Messrs. Lacey, Sillar and Leigh. . . . The installation as now running was carried out by the electricity department of the Manchester Corporation, to designs prepared by the British Thomson-Houston Co., Ltd., of Rugby, constructed and erected under the supervision of our consulting engineers, Messrs. Lacey, Sillar and Leigh, electrical engineers, and Mr. W. Nelson Bower, mechanical and electrical engineer."

U.S. Bureau of Steam Engineering.—The annual report of this Bureau for 1909 is to hand. Much of the information consists of mere records and categorical statements of work done or of ship equipment at various U.S. arsenals or navy yards. There is a section which deals with the engineering experiment station at Annapolis, Md., from which may be gathered that tests were begun with the condensers of some Parsons turbines, but were abandoned because of the variable quality of the exhaust steam, which prevented correct observations being made on the performance of the condensers. Condensers fitted with water-catching diaphragms and other condensers are to be tested. Tests on Sirocco blowers seem to show that the De Laval turbine will prove the best motor for such fan blowers. CO_2 recording apparatus has been proved useful in the preliminary selection of firemen. Coal calorimetry is decided to be only successfully put into practice by experts. Metal corrosion tests are being planned out with a view to finding the effect of pressures of 275 lb. per sq. in. This should throw further light on the behaviour of Thames water in water-tube boilers along the tideway. Oil testing is to be applied to all the oil furnished to the United States Navy. All boiler water gauges proved unequal to the effects of 270-lb. steam. The best only endured three months, and better glass is asked for. The opinion is expressed that the large gas engine and producer is worthy of much more serious investigation than has yet been given to it in the United States Navy. As regards oil fuel, it is proposed to try such systems as atomise the oil mechanically at high temperatures, the necessary air for combustion being supplied by blowers of the regular forced-draught type. All these references are extremely brief, and merely show the trend of opinion. It would be more interesting to have more lengthy reports on the results of the various tests made or intended to be made.

Electric Gas Lighter.—The Pax Patents Co., 16, John Street, Adelphi, are introducing a system of lighting gas lamps with electric sparks produced by a small induction coil, thus doing away with the by-pass. Each burner is supplied by a pipe from a suitable "switchboard," an insulated wire conveying the spark to the burner, and behind each switch (*i.e.*, tap) is a fibre disk, which being pressed in the act of turning the switch (tap), momentarily closes the primary circuit of the coil. Thus the battery has very little work to do. The same company is introducing the "Pharoso" system of lighting—our old acquaintance, the petrol air-gas system—and makes the usual erroneous statements regarding the cost of various illuminants, like those which we have dealt with from time to time.

Tide Utilisation.—The old idea of utilising the rise and fall of the tide in connection with the production of electricity has been revived by August Hanns, of Berlin, who has placed before the Oldenburg Diet a scheme for dealing with the ebb and flow in the Jade Bay. The scheme projects the supply of cheap light and power to the districts of the bay and the adjoining districts of Prussia and Bremen. According to the calculations made by the author of the scheme, who has petitioned the Diet for a grant of £3,000 for the installation of experimental plant, the cost of production would amount to from ½d. to $\frac{3}{16}$d. per KW.-hour.

The Electro-Deposition of Aluminium. — The directors of the Mix & Genest Co. announce that they have succeeded in devising a process which renders it possible to deposit metal coats on aluminium by electrolysis. The process forms the subject of patents, and is said to have already stood the test of practice.

Electric Fatality in India.—The *Indian and Eastern Engineer* reports that Mr. Natsen, aged 34, an engineer who went out specially to erect a cyanide plant at the Tank Block Mine, Kolar Goldfields, was unfortunately killed by an electric shock of 2,000 volts on January 13th. "He had nearly completed his own special work, when the services of an electrician were found necessary. He attempted the work, although not in his line, with the fatal result recorded."

American Exhibition in Germany Abandoned.—It is reported that the idea of holding an exhibition of American products in Berlin in the coming summer has been abandoned "owing to the uncompromising attitude of the German Government," says the *Times* Washington correspondent.

EXTENSIONS AT THE BURNLEY ELECTRICITY WORKS.

In December last, the large extensions which have been carried out at the Burnley Corporation electricity works during the last two years were officially opened.

Local conditions had to be taken into consideration in the design of these extensions, with the result that one or two rather interesting departures from the usual run of such work have been made.

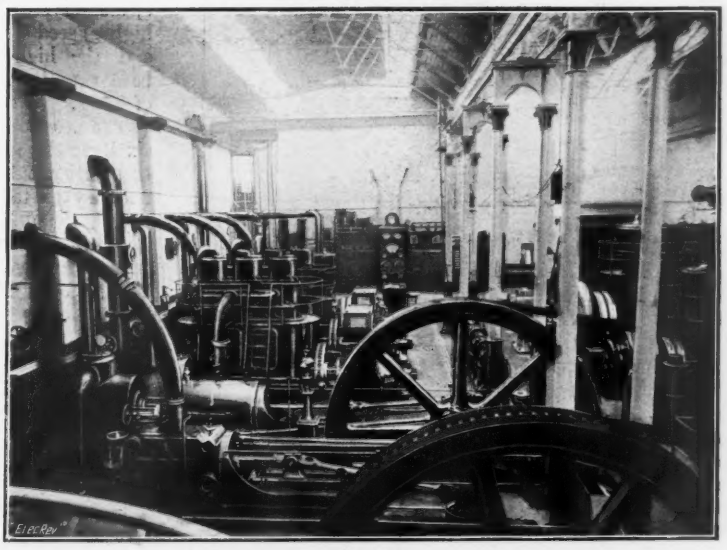
There was a lack of room for extensions, and a shortage of water for condensing purposes.

The Burnley electricity works provides one of the best or worst (according to the point of view) examples of the mistaken ideas as to the probable growth of electricity supply that were prevalent in the early days of the industry in this country, and perhaps a short *résumé* of the concern will make this clear.

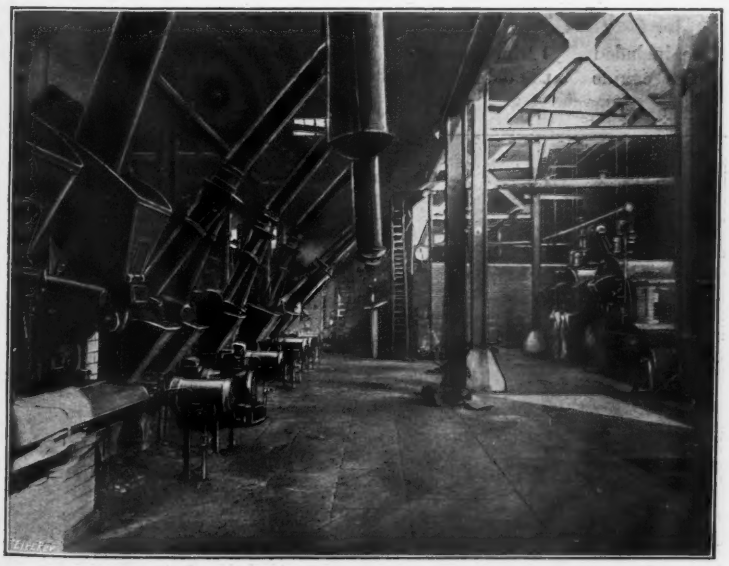
The supply of electricity was commenced in August, 1893, the site chosen for the generating station being that of an old cotton mill in Aqueduct Street on the banks of the River Calder.

The plant consisted of two Lancashire boilers, each of some 300-H.P. capacity at 120 lb. pressure, supplying steam to two slow-speed horizontal engines fitted with Corliss valve gear and rope coupled to two E.C.C. bipolar dynamos.

These engines are each capable of developing 225 I.H P. The dynamos were designed for an output of 400 amperes at 230 volts. Water for the condensers and boiler feed was obtained from the adjacent River Calder, and coal was delivered from local collieries. The first extension became necessary in 1895, and consisted of the addition of another slow-speed engine similar in design to those already installed, but of increased capacity, and also rope coupled to an E.C.C. bipolar dynamo, designed to give 625 amperes at 240 volts. In 1899 it was found that the capacity of the plant would very soon be overtaxed, so a change was made and the system converted from a three-wire system with 220 volts across the outers to a three-wire system with 440 volts across the outers, and here it may be mentioned that Burnley was one of the towns that had to pay a royalty for using the three-wire system. In addition, two new 350-KW. generators were installed, consisting of Belliss engines and E.C.C. bipolar dynamos. Korting ejector condensers were fitted to these sets, and two motor-driven centrifugal pumps were installed to lift the water for condensing from the adjoining river to a storage tank on the boiler house roof; that year also saw the first extension to the boiler house, where a third boiler was installed similar to the two already in, and in addition considerable structural alterations were made to the buildings with the object of providing room for these and future extensions.



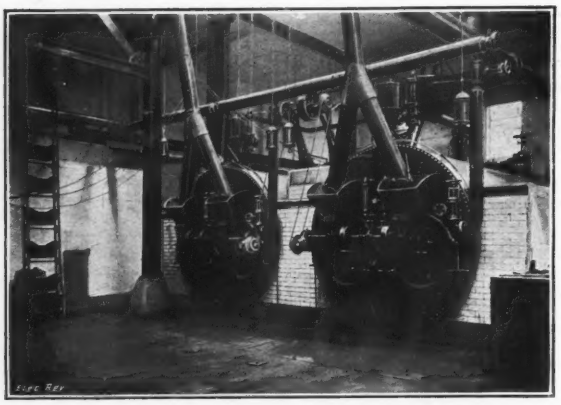
Interior of the Engine Room Showing the East Bay, Burnley Electricity Works.



Boiler Plant, Burnley Electricity Works.

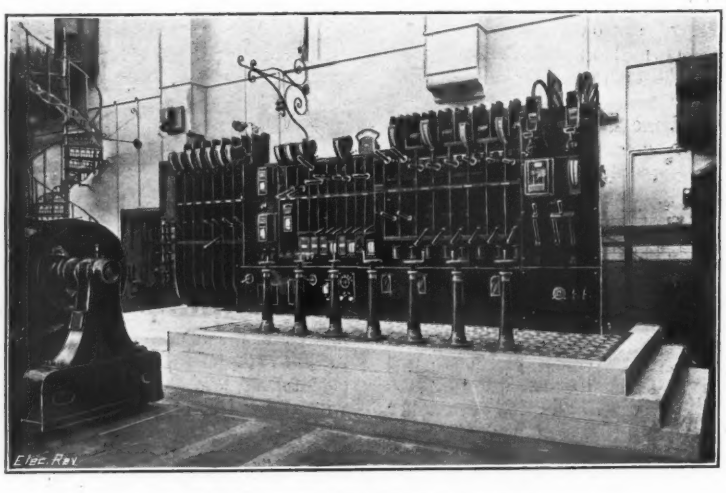
In 1901 the first electric tramcars were running in Burnley, and by 1903 the whole of the old steam tramways had been converted and some new branch lines opened. To meet the demand of the tramways, further extensions were required at the power station. Nos. 1, 2 and 3 dynamos were rewound as compound machines for 500 volts and a new triple-expansion Belliss engine, direct coupled to a Dick, Kerr multipolar dynamo with a capacity of 250 KW., and fitted with an ejector condenser, was installed. Two Lancashire boilers were also added, and a traction battery and Highfield reversible booster were put in. In 1904 the station load had increased sufficiently to warrant another extension, and a duplicate set to the last one was installed, and with this plant the winter load of 1904-5 was carried, but the maximum load continued to increase so rapidly that it was seen that the following winter would be a very anxious time unless more plant was installed, as the percentage increase for the year March, 1904, to March, 1905, showed that the output had been 58 per cent. higher than in the previous year, the result being that a 500-KW. triple-expansion Belliss-Dick, Kerr generator and an additional boiler with a Bennis stoker were installed. In connection with this set, it was found that the head of water available was not sufficient for the size of the ejector condenser necessary for the engine, so the difficulty was overcome by putting in two smaller condensers in parallel,

and the arrangement has worked very satisfactorily. With this extension the local disadvantages assumed awkward proportions. In the summer of 1906 the quantity of water for condensing purposes had reached such a large amount, and the supply of water in the river such a low level, that on one or two occasions the supply was not equal to the demand, and some of the plant had to be run non-condensing for a few hours on the peak load, so that a Klein cooling tower was installed before the summer of 1907.



New Lancashire Boilers with Proctor Stokers, Conveyor, &c.

When the last extensions came under consideration the first points to be settled were what plant to install, and when and where to install it. One 750-kw. generator and two boilers with auxiliary plant were included in the borough electrical engineer's report. The engine room and the boiler house were already filled to their utmost capacity with plant, nor was it possible to extend them except as regarded the boiler house, so it was decided that one of the first pair of slow speed horizontal engines should be removed, and a high speed set installed in its place, and any future extensions will have to be carried out on the same lines. The second drawback at Burnley is the shortage of the water supply for condensing purposes. To meet this, cooling towers were installed in 1906, and these have since been added to, and provision has been made in the present extension for further additions.



The Traction Switchboard, Burnley.

The new generator consists of a Belliss triple-expansion high speed engine of standard make, direct coupled to a Dick, Kerr multipolar continuous-current generator with an output of 750 kw., and the combined set will run with 20 per cent. overload for one hour without any undue increase in temperature of any portion.

The engine is designed to work with a steam pressure of 160 lb. per sq. in. and 150° F. of superheat at the engine stop valve, and under these conditions the set is guaranteed to give an overall efficiency of 88·3 per cent. at full load, with 24 in. of vacuum at the engine exhaust branch. The question of a condenser for this set was carefully gone into, keeping in mind the fact of the water supply being poor, and that the condensing scheme would have to be arranged to meet future extensions, and it was decided to adopt a Westinghouse-Leblanc plant, a type somewhat new to this country. The condenser is of the multiple jet type, and was described at some length in this Journal in the issue of October 29th, 1909. The points in its favour are the much smaller quantity of water required as compared with the ejector types which are installed with all the other high speed sets, that it is entirely self-contained, and the high vacuum promised for it. The set has been running for some time, and has maintained a vacuum of 27 in.

The new boiler house extension includes: Provision for six Lancashire boilers, pump room for two feed pumps, 800 economiser tubes, coal and ash handling plant, and a chimney to take the gases from 12 Lancashire boilers and superheaters.

The building was constructed from the plans of the borough surveyor, Mr. G. H. Pickles, the building contractors being Messrs. Mullen & Durkin, of Burnley. The new boiler house has a flat roof, which forms a tank and platform for carrying the cooling towers; it is built of concrete reinforced with steel girders, and the walls are carried up 2 ft. above the top surface to form the tank. The whole of the top and sides were covered with bitumen to make them watertight and sloped to an outlet, sufficiently to make the water all drain to that point, which is connected by 12-in. pipes to the circulating water tank on the top of the old boiler house.

View of the Test Room.

The chimney is circular in section, 9 ft. inside diameter and 210 ft. high; steel rings treated with non-corrosive

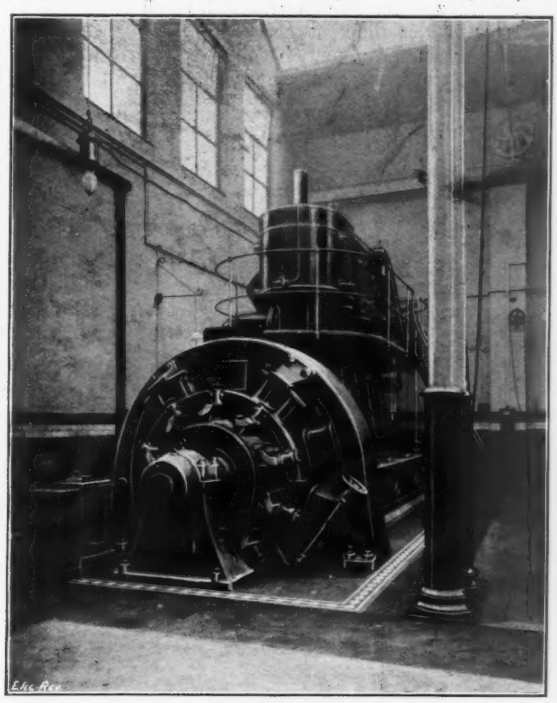
paint are built into the structure every 30 ft. about 4½ in. from the outside, to give greater elasticity.

The plant installed in the new buildings consists of two Lancashire boilers fitted with Proctor patent shovel stokers with moving bars, and Sugden superheaters. A Green patent economiser consisting of 400 tubes is fixed in the main flue.

A motor drives a countershaft suspended from the roof, and from this both the stokers and economisers are driven, the arrangement being capable of easy extension for any future requirements. In the pump room an additional Hall compound steam feed-pump, with a duty of 7,000 gallons per hour, has been installed. The whole of the steam and feed range is constructed of wrought-steel lap-welded pipes, and in addition, about half of the old steam range has been rebuilt with steel pipes, these being supplied and erected by Messrs. Stewarts & Lloyds. The coal-handling plant consists of coal elevators, bunkers, and ash elevators and bunker, built by Messrs. Ed. Bennis & Co.; the bunkers are carried on stanchions between the old and new boiler fronts, and have a capacity of 300 tons. The elevator is of the endless chain bucket type, driven by a 5-H.P. motor, and is capable of dealing with 20 tons per hour.

For dealing with the circulating water, a Rees-Roturbo pump has been added capable of lifting 75,000 gal. of water per hour with a head of 32 ft., the piping for which has been arranged so that the machine can be used either for lifting water from the river to the storage tank or for lifting water from the hotwell over the cooling towers.

The extensions have been carried out to the designs of Mr. J. E. Starkie, the borough electrical engineer, and the whole of the work has been carried out under the supervision of Mr. Starkie and his staff.



Burnley Electricity Works: New 750-kw. Generator.

THE USES OF OZONE: THE OZONAIR SYSTEM.

Although the valuable properties and varied uses of ozone have been well known for many years, this interesting substance has not yet obtained the recognition to which it is entitled. It is true that it has been applied to the sterilisation of water for town supply in several places on the Continent and in America, and that it has been used for the bleaching of flour, &c., but the small number of instances in which it has been so employed only throws into greater relief the fact that it has been generally neglected. Whether this has been due to the inefficiency of the apparatus employed, to the want of expert knowledge, or to the lack of business ability on the part of those by whom it has been handled in the past, we cannot say, but we are inclined to think that all three of these adverse influences have been contributory to the unfortunate result. But there is a great future before ozone, in domestic, industrial and medical applications; it is easily produced, and the apparatus is so simple that it is practically fool-proof and unlikely to get out of order, while the chemical and other properties of the substance are so striking and valuable that they cannot indefinitely remain unused.

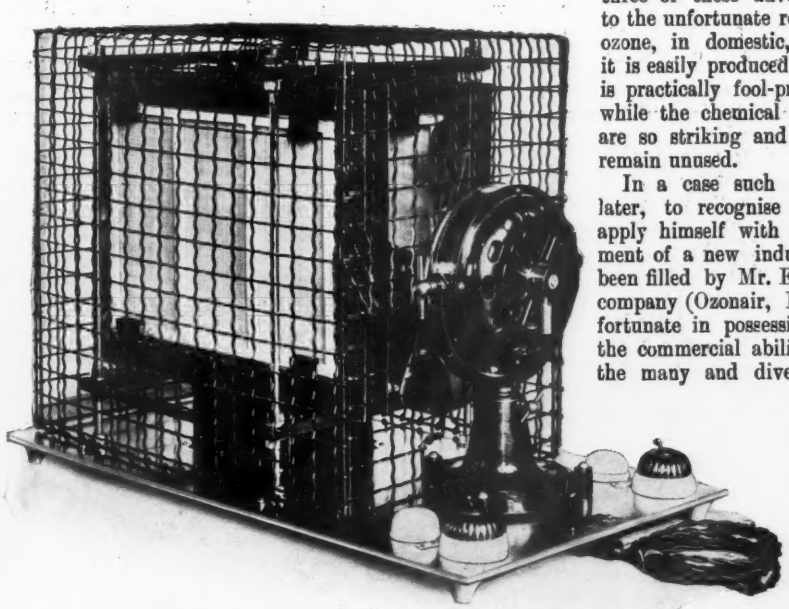


Fig. 1.—Latest Type of Portable Ozone Generator.

In a case such as this, some one is sure, sooner or later, to recognise and grasp the opportunity, and to apply himself with energy and resolution to the development of a new industry. In this instance that *rôle* has been filled by Mr. E. L. Joseph, managing director of the company (Ozonair, Ltd.) which he has founded, who was fortunate in possessing both the technical knowledge and the commercial ability essential to a successful solution of the many and diverse problems involved. Commencing with small apparatus for medical and domestic use, Mr. Joseph has developed the system of generating ozone which he adopted, from its crude initial form to a remarkably high degree of efficiency, without sacrificing simplicity or reliability, and at the same time he has succeeded in building up a business which offers excellent prospects for future development.

It is both interesting and significant that the company's success is in great measure to be ascribed to scientific investigation, patiently and perseveringly pursued until the desired object has been attained. Accurate measurement underlies the whole organisation. Mr. Joseph is not content with apparently satisfactory results; the actual pro-

duction of ozone must be ascertained, its effect on various substances under different conditions of humidity, temperature, pressure, &c., must be observed, and when success has been attained, the complete data must be on record, so that the whole of the conditions can be reproduced at pleasure.

We have prefaced our references to the applications of ozone by this explanation in order to make it quite clear that the ozone generator business is being carried on not as a harmless fad, but as a serious industrial undertaking, capable of growth to very large proportions. Turning now to the directions in which the system has already been developed, we may begin with the small portable apparatus which were first in point of time, if not of importance. Some of these, made for use in private houses and offices, we have already described ; they are made for D.C. and A.C., weigh

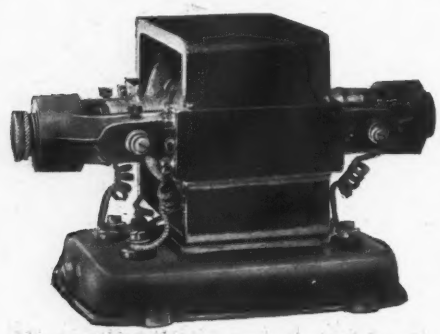


Fig. 2.—Small Rotary Converter (20 watts).

Fig. 3.—Small Portable Generator.

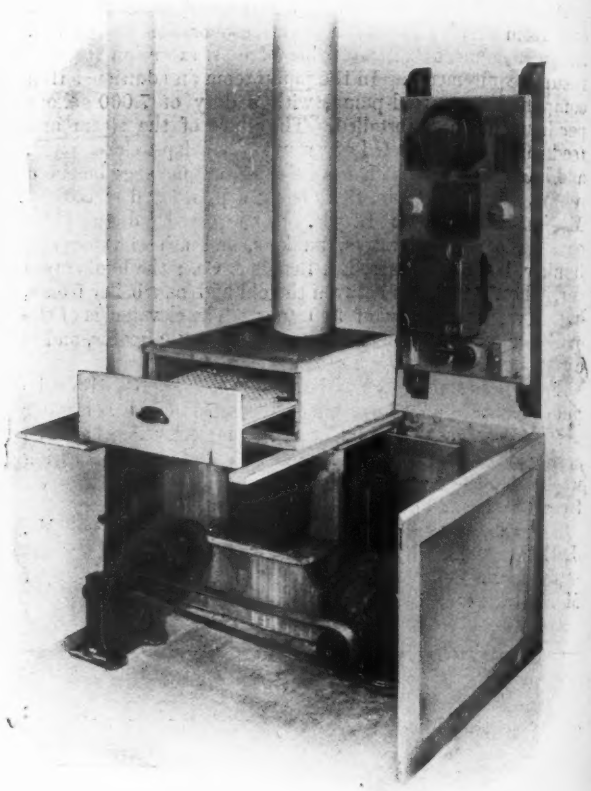


Fig. 4.—Combined Ozonising and Ventilating Installation, open.

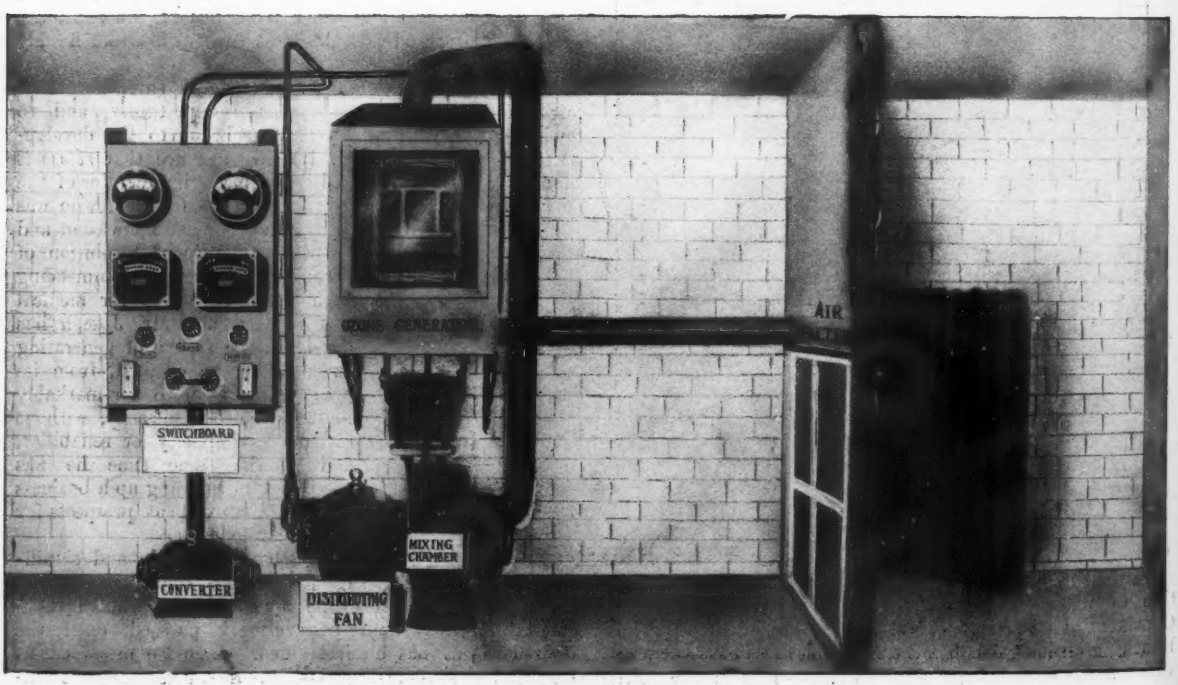


Fig. 5.—Ozonair System of Ventilating Buildings in very Hot or Cold Climates.

20 to 30 lb., and consume 20 or 30 watts when running. A new pattern, in which the apparatus stands on legs, the converter being conveniently accommodated on the base of the stand, is shown in fig. 3, without the converter, which is shown separately in fig. 2, and is provided with ball bearings. Various modifications of the apparatus, for fixing on the wall, for working off a small portable set of accumulators, and so on, are made, and larger sizes suitable for use in public halls, factories, schools, &c., have been standardised; the latter are completely self-contained, the high-tension transformer being placed inside the ozoniser, with the electric fan at the rear. The apparatus are all provided with wire guards, and are perfectly safe to handle, as the act of opening any of them shuts off the current. The larger sizes, last mentioned, consume from 65 watts (A.C.) to 100 watts (D.C., with converter), including the power taken to drive the fan; it is obvious, therefore, that the cost of the ozone is trifling. The latest pattern, shown in fig. 1, is contained in a wire cage, with an aluminium base-plate.

From these minor apparatus we come to the large-scale applications of ozone, which at present extend in three main directions: chemical, as for bleaching flour, oil, &c.; bactericidal, as for disinfecting hospital wards, sterilising water, &c.; and ventilating with ozonised air. In all these directions Messrs. Ozonair, Ltd., have been for some years conducting researches in their own laboratories, which are admirably equipped for the purpose, and excellent results have been obtained. Only the last-mentioned is a suitable subject for illustration; we give herewith a view of a complete installation (fig. 4) adapted for the ventilation of a building of 6,000 to 18,000 cb. ft. capacity, and containing within a neat enclosure a motor-driven fan, which draws the air through a screen of absorbent cotton-wool, an ozone generator, step-up transformer, and the necessary start-

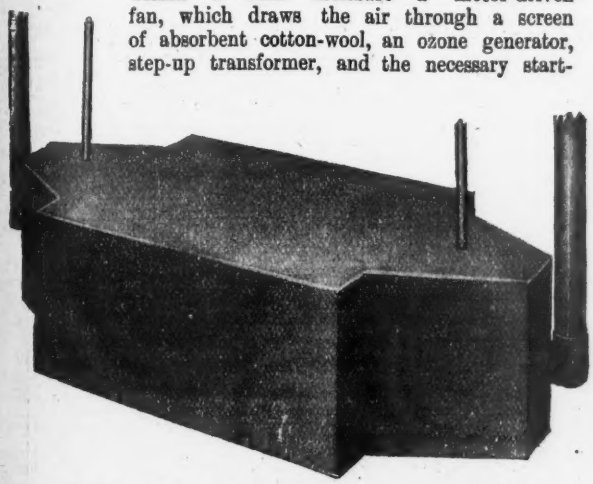


Fig. 6.—Totally Enclosed Grid Generator for Industrial Processes.

ing and controlling switchgear, fuses, ammeter, &c. When closed, the apparatus resembles an unobtrusive cupboard or cabinet. It is interesting to note that the firm has succeeded, in the case of D.C. supply, in combining the fan-motor with the converter, thus effecting a material saving in cost; the machine is provided with ball bearings, and can run for months without attention. A larger installation is shown in fig. 5; the air outlet to the building is in this case downwards through the floor, and the apparatus is designed to circulate the bulk of the air within the building, while adding to it a proportion of fresh air drawn from outside through a screen and mixed with the main flow, as indicated on the figure. This system, which is especially suitable for use in very cold or very hot climates, has the great advantage that the temperature can be maintained at a uniform value without the necessity of heating (or cooling) large quantities of air drawn from outside the building. The radiator shown outside the screen provides for the heating or cooling of the make-up air drawn from without. The purity of the circulated air is ensured by the use of ozone, which destroys the deleterious organic emanations from the bodies of the inmates. We understand that this system has come into extended use in Russia, a country where fresh air indoors has hitherto been unknown in winter.

The apparatus used for disinfecting produces a highly concentrated supply of ozone, and is wholly enclosed in a teak case, running on castors; it is designed to deal with spaces of 3,000 to 7,500 cb. ft., and takes from 100 to 250 watts, according to size.

For industrial purposes a different pattern of ozone generator is employed, which we illustrate in fig. 6. This is totally enclosed in a water-tight cast-iron case, which can be immersed in water for cooling purposes; with this apparatus the air can be used under pressure, and ozone can be produced at a very high degree of concentration.

At the new offices of Ozonair, Ltd., examples of all these apparatus have been fitted up as permanent exhibits, together with others; for instance, the bleaching of flour is shown in actual operation, as well as the protection of the wort and yeast from contamination in the process of brewing beer. In the bleaching of palm oil for soap manufacture remarkably good results have been secured, thanks to minute attention to detail, and a better result is obtained than can be secured by the usual chemical methods, at a far lower cost.

As we have said, there is a great future before ozone, and we are pleased to put on record the progress that has been made by this energetic firm towards its early realisation.

NATIONAL ELECTRICAL MANUFACTURERS' ASSOCIATION.

The fifth annual general meeting was recently held at the Association's offices, Balfour House, Finsbury Pavement, E.C., Mr. H. H. Berry being elected to the chair. Before the report, to which reference has already been made in the Electrical Review, was considered, the insurance expert attached to the Association made his report to the meeting, and explained that an appointment such as he held, although unusual in this country, was common in the United States. He explained to the members the very material benefits to be secured by utilising this department of the Association. Many of the members had thus been able to obtain considerable reductions in premiums, besides valuable aid in the adjustment and settlement of claims, &c.

The Committee's report, which was taken as read, was commented on by the chairman, and various members of the Committee who had specially dealt with the different items mentioned gave further explanations regarding them.

Various suggestions as to increasing the utility of the Association were made by the different members, the general view being that the Association was now in a position in which it rendered much greater benefit to the members than had ever been the case previously. There was also a consensus of opinion to the effect that the work done by the Association was insufficiently appreciated by manufacturers, and attention was drawn to the fact that much more could be done if the membership were increased.

The report was unanimously approved and passed, as also were the accounts.

The following constitute the committee for the current year: H. H. Berry (Berry, Skinner & Co.); H. Bevis (Pirelli, Ltd.); H. W. Butler (Electrical Power Storage Co., Ltd.); E. J. Clark (Hart Accumulator); D. N. Dunlop (British Westinghouse Co., Ltd.); T. J. Grainger (Sunbeam Lamp Co.); B. Longbottom (Electromotors, Ltd.); A. P. Lundberg (A. P. Lundberg & Sons); F. H. Nalder (Nalder Bros. & Thompson, Ltd.); H. Oppenheimer (International Electric Co.); A. P. Pope (Johnson & Phillips); B. Broadhurst (Brush Electrical Engineering Co., Ltd.); H. C. Siddeley (Lancashire Dynamo and Motor Co., Ltd.). Messrs. Beaver and H. Stanley Marsh were elected hon. auditors.

After considerable discussion on the question of date, it was decided that this Association should hold an Electrical Exhibition in London at Olympia in October, 1911. Full details of the arrangements regarding this exhibition will shortly be given.

The Adams Manufacturing Co., Ltd., of Bedford, and Messrs. Rhodes Motors, Ltd., of Doncaster, were elected members of the Association.

Easter Holidays in Spain.—The more British electrical men travel in foreign countries, whether on business or on pleasure bent, the better will it be for our industry. One country which ought to receive greater attention from us, as we have often said, is Spain. We therefore have pleasure in drawing attention to a very attractive little brochure, "Trips through Spain," in which some beautiful views of the country, forming excellent examples of colour printing, are given. It is issued by the Orleans, Midi, North of Spain, Madrid-Saragossa, Alicante and Andalusian Railways, and gives particulars of reduced fares for the Easter Holidays and the present spring.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Dartford Council has approved a recommendation of the E.L. and Tramways Committee that the salary of the electrical engineer, Mr. J. D. Pember, be increased from £250 to £275 per annum.

The officials and employés of the West Ham Corporation electric supply department recently held their first annual dinner at the Princess Alice Hotel, Forest Gate. During the evening Mr. Uffleman, who has left the department to join the Westinghouse Co., was presented with a silver stop watch.

Mr. H. A. Barnett, B.Sc., A.M.I.E.E., who was resident engineer for the Clyde Valley Electrical Power Co. for nearly six years, sailed on the 12th inst. for New York, *en route* for Canada.

The *Indian and Eastern Engineer* says that Mr. Frank Rawson, C.M.G., agent and manager of the Calcutta Supply Corporation, will join the Indian Imperial Council as "Additional Expert Member" during the consideration of the Electricity Bill.

Mr. A. W. Dumbrill, commercial assistant to the Battersea Borough Council electricity department, resigned his appointment on Friday last in order to take up a more lucrative position with Messrs. J. and H. Grevener. As a mark of esteem he was presented by his colleagues with a chiming clock, Mr. Bond, chief electrical engineer, referring in a speech to the valuable assistance rendered by Mr. Dumbrill to the undertaking.

The staff of the Dundee Corporation Electricity Department celebrated the opening of the new station by a dinner last Tuesday, when Mr. H. Richardson, the engineer, presided. Mr. D. H. Bishop presented Mr. Richardson with several handsome gifts, including a silver match box from the staff of the Department, as a mark of esteem and respect. Mr. Richardson responded, and other speeches followed.

The Stockton-on-Tees T.C. has increased the salary of Mr. J. J. Smith, electrical engineer, by £20 a year.

Owing to the Federation scheme, the Hanley T.C. has decided to grant testimonials under seal, covering their services with the Council, to the borough electrical engineer, and Mr. W. Adams, the deputy-electrical engineer, expressing appreciation of their services.

The Southport Electricity and Tramways Committee of the T.C., as mentioned last week, has recommended that the two undertakings be placed under one management, with Mr. Kendrew, tramways manager, as deputy electrical engineer, under Mr. Black.

The Burslem T.C. has increased the salary of Mr. Bremner, electrical engineer, from £350 to £400 per annum from March 1st. Mr. H. C. Heath, chief shift engineer, has been appointed mains superintendent, and the salary of Mr. H. W. Edwards, assistant electrical engineer, has been advanced.

Tramway Officials.—Mr. T. E. Thomas, district engineer at Kingston-on-Thames, of the London United Tramways, who has been transferred to the engineering department of the Underground Electric Railways, has been presented by the Surrey staff of the tramway company with a silver-mounted cut-glass cigarette box.

General.—The appointment of associate-head of the electrical engineering and applied physics department at the Northampton Polytechnic Institute having been rendered vacant by the resignation of Dr. C. V. Drysdale, who has been on the staff of the Institute since its opening in 1896, Mr. F. M. Denton has been appointed to the post. Mr. Denton received his technical training at the Central Technical College of the City and Guilds of London Institute, and subsequently was employed in the instrument-making works of Messrs. Elliott Bros., London, and the Oerlikon works, in Switzerland. After a year on the staff of the electrical engineering department of the Central Technical College, he joined the staff of the General Electric Co., at Pittsfield, Mass., and at Schenectady. Two and a half years ago he was appointed lecturer in electrical engineering at the new Carnegie Technical Schools at Pittsburg, a position which he is resigning to take up his London appointment.

Obituary.—Mr. H. J. Rogers.—The death occurred very suddenly on March 9th of Mr. Henry J. Rogers, A.M.I.E.E., electrical engineer, of High Street, Watford. Deceased, who had been in business at Watford since 1885, was in his 65th year.

The death occurred on March 1st at Alexandria, Egypt, of Monsieur Emile-Edouard Henricot, of the Henricot Steel Foundry.

NEW COMPANIES REGISTERED.

British School of Telegraphy, Ltd. (107,604).—This company was registered on February 19th, with a capital of £1,500 in £1 shares, to carry on schools or colleges for the training of persons in telegraphy, cable-graphy, radio-telegraphy and telephony, electricity, magnetism, and electrical and mechanical engineering, &c., and to acquire the business carried on by A. W. Ward and A. W. Sharman, at 179, Clapham Road, Clapham, and elsewhere, as the British School of Telegraphy. The subscribers (with one share each) are:—A. W. Ward, 179, Clapham Road, S.W., school proprietor; A. W. Sharman, 9, Brockwell Park Gardens, Herne Hill, S.E., electrical engineer; E. A. Poole, 46, Emmanuel Road, Balham, S.W., solicitor. Private company. The number of directors is not to be less than three or more than five; the first are A. W. Ward, A. W. Sharman and E. A. Poole. Registered office, 179, Clapham Road, S.W.

"Float" Electric Co., Ltd. (107,336).—This company was registered on February 4th, with a capital of £10,000 in £1 shares, to carry on the business of electricians, engineers, manufacturers of electrical and other machinery, &c. The subscribers (with one share each) are:—E. L. Cozens, 2, Forest Villas, Walpole Road, South Woodford, clerk; W. F. Tidyman, 4, Princess Road, Finsbury Park, N., clerk. Private company. The number of directors is not to be less than two or more than five; the first are to be appointed by the subscribers; remuneration as fixed by the company. Registered by Mayo, Elder & Co., 10, Draper's Gardens, E.C.

F. McNeill & Co., Ltd. (107,583).—This company was registered on February 18th, with a capital of £15,000 in £1 shares, to take over the business carried on at Lamb's Passage, E.C., and at Glasgow and Stockton, as "F. McNeill & Co.," and to carry on the business of manufacturers of and dealers in roofing, lining and sheathing felts, slag, slag-wool, silicate cotton, pipe, boiler and cylinder coverings, asbestos fireproof materials, refrigerating and insulating materials, &c., and to adopt an agreement with G. A. Nelson. The subscribers (with one share each) are:—G. A. Nelson, 14-22, Lamb's Passage, Bunhill Row, E.C., manufacturer; H. G. W. Brinsley, 30, 31, New Bridge Street, E.C., surveyor. Private company. G. A. Nelson is permanent governing director, subject to holding a majority of the paid-up shares. Registered offices, 14-22, Lamb's Passage, Bunhill Row, E.C.

W. P. Theermann & Co., Ltd. (107,501).—This company was registered on February 14th, with a capital of £5,000 in £1 shares (2,500 preferred), to take over the business of an electrical engineer and contractor carried on by W. P. Theermann, at 263, Oxford Road, Manchester and elsewhere, and to adopt an agreement with J. S. Higham. The subscribers (with one share each) are:—W. P. Theermann, 263, Oxford Road, Manchester, electrical engineer; J. S. Roylands, 13, Westminster Street, Levenshulme, Manchester, electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are to be appointed by the subscribers; qualification, £50; remuneration as fixed by the company. Registered office, 263, Oxford Road, Manchester.

J. B. Marr & Co., Ltd. (107,559).—This company was registered on February 17th, with a capital of £1,000 in £1 shares, to carry on the business of merchants and agents for British and foreign manufacturers, electricians, electrical engineers, &c., and to adopt an agreement with J. W. Breeze, A. S. King, and J. B. Marr. The subscribers (with one share each) are: J. W. Breeze, 2, Walton Street, Aylesbury, Bucks., director; J. B. Marr, 21, Waldegrave Gardens, Strawberry Hill, electrical engineer. Private company; the number of directors is not to be more than five; the first are J. W. Breeze (chairman) and J. B. Marr; remuneration of J. W. Breeze as chairman, £25 per annum. Registered office, 53, Victoria Street, Westminster.

Fluorundum Flame Carbons, Ltd. (107,585).—This company was registered on February 18th, with a capital of £5,000 in £1 shares, to acquire from F. M. Lewis and H. S. Hatfield, licences to manufacture, use, and vend certain inventions relating to enclosed electric flame lamps and electric lamp electrodes, &c. The subscribers (with one share each) are:—F. M. Lewis, Prudential Garage, King Street, Brighton, electrical engineer; W. Chester, jun., 1, Palace Place, Brighton, fitter. Private company. The number of directors is not to be less than two or more than five; the first are F. M. Lewis and H. S. Hatfield; qualification, £1. Registered by Jordan & Sons, Ltd., 116-7, Chancery Lane, W.C.

Slag Power, Ltd. (107,722).—This company was registered on February 23rd, with a capital of £20,000 in £1 shares, to carry on the business of generators of power by heat, light, steam, electricity or otherwise. The subscribers (with one share each) are:—L. Boorer, 18, Arngast Road, Catford, S.E., clerk; G. Sampson, 38, Gastien Road, Fulham, clerk; P. B. Smyth, 30, Grove Road, Wanstead, accountant; E. F. Heaton, 96, Highbury Place, N., manager; J. R. Broadley, 60, Princes Avenue, Alexandra Park, N., engineer; H. S. Rhodes, 4a, Campsbourne Gardens, Hornsey, N., engineer; F. F. Fuller, Cheverley, Netherby Road, Honor Oak, S.E., secretary. Minimum cash subscripton 7 shares; the number of directors is not to be less than two or more than seven; the first [are E. M. Touzeau and A. E. Beechano; qualification, £100; remuneration, £100 each per annum (chairman, £150). Registered office, 68, Salisbury House, London Wall, E.C.

South Brazilian Railways Co., Ltd. (107,723).—This company was registered on February 23rd, with a capital of £150,000 in £1 shares, to acquire a tramway and concessions regulating the same known as the "Empresa Ferro Carril Curytibana," Curytiba, Parana, Brazil, and to carry on the business of tramway and railway proprietors, manufacturers of and dealers in motor cars, cabs, omnibuses and other vehicles, &c., and to adopt an agreement with E. F. de Laveleye. The subscribers (with one share each) are:—W. J. Hawks, 30, Colesaine Road, Blackheath, solicitor; M. W. Starling, 42, Hastings Street, W.C., clerk; E. R. Gillingham, 100, Huddleston Road, Tufnell Park, N., clerk; W. Heath, 56, Church Street, Stoke Newington, N., clerk; C. Furness, 24, Blandford Road, St. Albans, clerk; A. Higgins, 27, Tremadoc Road, Clapham, clerk; E. A. Johnson, 782, Upper Holloway, N., clerk. Minimum cash subscription seven shares. The directors are to number not less than three or more than seven: E. F. de Laveleye is one of the first; qualification, £100; remuneration, £200 each per annum (chairman, £250) and a share in the profits. Registered by Gilbert Samuel & Co., 5 & 6, Great Tower Street, E.C.

Vaca Falls Co., Ltd. (107,711).—This company was registered on February 23rd, with a capital of £35,000 in £1 shares, to carry on the business of constructors and workers of railways, tramways, harbours, canals, sanitary, water, gas, electric light, telephonic, telegraphic, power supply and other works and conveniences, timber merchants, sawmill proprietors, planters, &c. The subscribers (with one share each) are:—J. E. Mills, Fgypt House, New Broad Street, E.C., clerk; A. E. Mills, Egypt House, New Broad Street, E.C., clerk. Private company. The number of directors is not to be less than three or more than seven; the subscribers are to appoint the first; qualification, 250 shares; remuneration, as fixed by the company. Registered by G. D. Perks, 35, New Broad Street, E.C.

Percival Brothers, Ltd. (107,673).—This company was registered on February 22nd, with a capital of £1,000 in 700 ordinary shares of £1 each and 1,200 deferred shares of 5s. each, to take over the business of electrical, mechanical and illuminating engineers carried on by R. G. Walker and H. G. Roberts. The subscribers are:—R. G. Walker, 23, Alexander Gardens, Folkestone, electrical and mechanical engineer, 400 deferred shares; W. J. Billington, 86, Macdonald Road, Walthamstow, electrical engineer, 200 pref. and 400 deferred; H. G. Roberts, 69, Buckland Avenue, Dover, business broker, 400 deferred. Private company. The number of directors is not to be less than two or more than seven; the first are R. G. Walker, W. J. Billington and H. G. Roberts; the two first-named are managing directors at £104 each per annum; qualification, £100; remuneration of H. G. Roberts, £52 per annum. Registered office, 11, Snargate Street, Dover.

Appleby Crane and Transporter Co., Ltd. (107,620).—This company was registered on February 21st, with a capital of £150,000 in £1 shares (100,000 preferred ordinary, and 50,000 ordinary), to carry on the business of makers of, and dealers in, electric and hydraulic cranes, hoists, lifts and all kinds of lighting and conveying machinery, engineers, tool makers, &c., and to adopt agreements (1) with W. B. Peat, as liquidator of Appleby, Ltd. (in liquidation), and (9) with Appleby, Ltd. (in liquidation), and E. G. Appleby. The subscribers (each with one share) are:—A. W. Baker, 1, Stoke Newington Common, N., gentleman; J. W. Percival, 4, Barnard Hill, Muswell Hill, N., private secretary; J. Claney, 104, Norfolk Road, N.E., cashier; R. J. Garwood, 267, Hainault Road, Leytonstone, gentleman; A. J. Kent, The Marples, Avenue Road, Wallington, accountant; R. Campbell, 38, Mornington Road, Leytonstone, shorthand writer; A. E. Newman, Kenora, Wenham Drive, Westcliffe-on-Sea, accountant. Private company. The number of directors is not to be less than seven or more than 11; the subscribers are to appoint the first; remuneration fixed by the company. Registered office, 57, Victoria Street, S.W.

Lobito, Benguella and Catumbella Electric Light and Power Co., Ltd. (107,947).—This company was registered on March 5th, with a capital of £200,000 in £1 shares, to generate, develop and accumulate electrical power at the Falls on the Catumbella River, Province of Benguella, Angola, Portuguese South-West Africa, and elsewhere, and to transmit, distribute and supply such power throughout Benguella, Catumbella, the Port of Lobito, and elsewhere, and to adopt an agreement with the Peninsular Development Syndicate, Ltd. The subscribers (with one share each) are:—E. W. Church, 70, Nightingale Road, Clapton, N.E., clerk; H. W. Hill, 104, Brockley Road, Brockley, S.E., clerk; E. R. S. Oxley, 159, Brixton Road, S.W., solicitor; W. E. Hunter, 117, Manor Street, Clapham, S.W., clerk; C. Brown, 18, Treherne Road, Brixton, S.W., clerk; W. G. Saunders, 32, Vicarage Road, Leyton, E., clerk; A. L. Nenmegen, 48, Kensington Hall Gardens, W., secretary. Minimum cash subscription, seven shares. The number of directors is not to be less than three or more than seven; the first are Sir Robert H. Drummond Hay, C.M.G., H. Reeve, C.M.G., M.I.C.E., F.R.G.S., A. S. Collard, J.P., B. D. Fox, A.M.I.C.E., and F. W. Kerr; qualification (except first directors or alternate directors) £200 shares or debenture stock; remuneration, £150 each per annum (£50 extra for the chairman), and a percentage of the profits. Registered office, 16, Victoria Street, S.W.

Pontelec Welding Patents, Ltd. (107,935).—This company was registered on March 4th, with a capital of £30,000 in £1 shares (10,000 7 per cent. cumulative preferred), to acquire and turn to account any invention relating to electric welding of steel and other metals, or any apparatus and machinery therefor, and to adopt an agreement with the Universal Electric Welding Co., of America, L. S. Lachman, E. B. Koopman and M. Lachman. The subscribers (with one share each) are:—C. V. Pugh, Radford House, Coventry, manufacturer; A. H. Gibson, 39, Waterloo Street, Birmingham, chartered accountant. Private company. The number of directors is not to be less than two or more than six; the first are C. V. Pugh and A. H. Gibson (pref. directors), and E. B. Koopman and S. J. Field (ordinary directors); qualification (except first ordinary directors), £250; remuneration, £100 each per annum (chairman, £200) and a share in the profits. Registered by Waterlow Bros. & Layton, Ltd., Birchin Lane, E.C.

Codes, Ltd. (107,863).—This company was registered on March 2nd, with a capital of £1,450 in 1,000 shares of £1 each and 9,000 shares of 1s. each, to carry on the business of printers, engravers, publishers, &c., and to adopt an agreement with J. M. M. Ribeiro for the acquisition of the rights of the said Jose M. M. Ribeiro in certain telegraphic codes. The subscribers (with one share each) are:—J. M. M. Ribeiro, 349, Chester Road, Manchester, merchant; J. H. Hoyle, 8, St. James' Road, Church, Accrington, mine owner. Private company. The number of directors is not to be less than two or more than five; the first are J. M. Ribeiro, J. H. Hoyle and J. Williams; qualification, 250 shares. Registered by Field, Roscoe & Co., 36, Lincoln's Inn Fields, W.C.

Cecil Hodges & Co., Ltd. (107,716).—This company was registered on February 23rd, with a capital of £1,000 in £1 shares, to carry on the business of electricians, engineers, wire drawers, tube makers, suppliers of electricity, &c. The subscribers (with one share each) are:—T. Howells, Feathers Hotel, Ledbury, merchant; C. Hodges, Wittenham, Lyonsdown Road, New Barnet, Herts. Private company. Table "A" mainly applies. Registered by W. T. Hick, 2, Church Court, Clements Lane, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Primitiva Gas and Electric Lighting Co. of Buenos Ayres, Ltd. (69,267).—Trust-deed dated January 24th, 1910 (supplemental to deed of July 8th, 1897, securing £250,000 4 per cent. debenture stock), charged on the company's undertakings and assets, present and future, subject to specific charge in favour of £600,000 1st debentures. Trustees: River Plate Trust Loan and Agency Co., Ltd., 52, Moorgate Street, E.C.

Coast Development Corporation, Ltd. (84,031).—Mortgage dated February 4th, 1910, to secure £1,750, charged on freehold land, electric lighting station and plant at Walton-on-Naze, with the benefit of Walton-on-Naze Electric Lighting Order, 1909, &c. Holders: J. Perry, Madeira House, Bromley; T. C. McIntyre, Northfield, Bickley; and T. P. Young, 29, Mark Lane, E.C.

Sunlight and Safety Lamp Co., Ltd. (94,132).—A memorandum of satisfaction in full on January 8th, 1910, of debentures dated September 5th, 1907, securing £14,000, has been filed.

New Phonopore Telephone Co., Ltd. (44,654).—Agreement dated February 9th, 1910, to secure £700 and further advances not exceeding £800, charged on the company's undertaking and property, present and future, including uncalled capital (if any). Holder: A. Haes, 17, Bishopsgate Street Within, E.C.

Tonks, Ltd.—A statement of the total amount outstanding on July 1st, 1908, in respect of mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 12 of the Companies' Act, 1907. Particulars: Mortgage debentures dated February 17th, 1896, to secure £21,700.

Madras Electric Supply Corporation, Ltd. (87,409).—A memorandum of satisfaction in full on January 1st, 1910, of mortgage dated February 22nd, 1906, securing £250,000, has been filed.

A. Hirst & Son, Ltd. (57,889).—Particulars of £3,600 debentures created 2nd and secured by trust-deed dated February 11th, 1910, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: Two freehold plots of land, with buildings thereon, at Batley Carr, and the company's undertaking and property, present and future, including uncalled capital, except certain freehold hereditaments. Trustees: E. D. Booth and W. H. Shaw, both of Dewsbury.

Cecil Hodges & Co., Ltd.—Particulars of £1,000 debentures created February 26th, 1910, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

CITY NOTES.

South London Electric Supply Corporation, Ltd.

Mr. J. Atherton presided on Tuesday over the meeting of this company held at Cannon Street Hotel, E.C.

The Chairman, in moving the adoption of the report (see Electrical Review, page 397), said they had added to the circuit during the past year the equivalent of 24,486 35-watt lamps, the total connections at the end of the year amounting to 210,394 lamps, since increased to over 212,000, and the total number of units sold was 3,705,208 as compared with 3,182,820 units in the previous year—an increase of 522,388 units or 16·5 per cent. That increase produced an additional revenue of £2,061, notwithstanding the increased use of the metallic-filament lamp. He thought they would agree that that result was very satisfactory, as he found that in the case of many other electric supply companies they had shown a decrease in their revenue owing to the use of these lamps. In the end, however these lamps would undoubtedly benefit the electric supply companies, and place them in a favourable position in regard to competition with modern methods of gas lighting. The gross profit of the year's work had increased by £1,632, and the average price received for the year was 2·32d. per unit, as compared with 2·54d in the previous year, or a decrease of 8·7 per cent. due to the proportion of units sold for power purposes last year being greater than in the previous year. The total costs per unit were 1·18d., against 1·34d. in 1908, a decrease of nearly 12 per cent. That satisfactory result had again been brought about by rigid economy in the operation of the whole of the company's plant, and not by the installation in their generating station of more economical plant. Further, it was satisfactory to note that, although they sold in 1909 over half a million more units than in 1908, the amount expended for coal during 1909 was £25 less than in the previous year. He thought that reflected great credit on their engineering staff. At the end of 1909 they had 3,000 H.P. of motors connected to the mains, being an increase of 750 H.P. during the year, and 1,416,819 units, or 38 per cent. of the units sold, were consumed by these motors. At the present moment negotiations were in progress with many prospective power and lighting consumers, some for large amounts of power, for which he had every reason to hope that contracts would shortly be concluded. The capital expenditure during the year amounted to only £7,891. That amount included among other things the equipment of a sub-station for giving a supply for lighting and power to a firm owning very extensive premises, who had entered into a contract with them for the whole of their supply for a number of years, having disposed of their own generating plant. He informed them at the last annual meeting that an order was then being placed for a 1,500-KW. steam turbo-alternator, complete with auxiliaries. That order was duly completed in the spring of last year, and the additional plant was now installed and taking its share of the load satisfactorily. He confidently expected that this plant would conduce to further economies in their generating costs, which were now at a low level, and compared favourably with others supplying electricity in the metropolis. They had sufficient plant to add 50 per cent. more load with very little capital expenditure, as only a small addition to the mains and accessories in connection therewith would have to be provided to give any additional supply that might be requisitioned. He thought, therefore, that although their capital expenditure for the past few years had been on a very moderate scale, it would be even smaller in the near future. Notwithstanding the unrest in the coal trade, he was glad to say that they had been successful in placing contracts for coal for the whole of the present year at prices appreciably lower than in the previous year, which, of course, would automatically reduce the generating costs. The gross profits for the past year were £20,830, and after deducting the sums mentioned in the report, they carried forward £14,125, and were able to declare the same dividend of 5 per cent. on the ordinary shares.

Mr. F. J. Leslie seconded the motion.

After a short discussion the report was adopted.

The Chairman, in putting the resolution to the meeting, remarked that they looked forward to a still further reduction in their working costs, and he thought the future of the company was assured. They did not intend to stop at 5 per cent.

A long and acrimonious discussion ensued on a motion for the re-election of the retiring directors—Capt. E. Ironside Bax and Mr. F. J. Leslie.

Mr. J. M. Henderson, M.P., made a long speech on the action of Mr. Watson, a shareholder possessing 12,000 shares, in nominating Mr. J. R. Salter for a seat on the board. He (the speaker), however, had the approval of Mr. Watson for withdrawing Mr. Salter's name.

Mr. Leslie defended his right to stand for re-election, and criticised at length a circular issued by Mr. Watson in support of Mr. Salter's candidature.

Mr. Salter replied that in connection with the concern mentioned by Mr. Leslie, with which he (the speaker) was associated, he and Mr. Henderson were appointed as receivers "to pull it out of the mud."

Eventually, after several shareholders had spoken deprecating the "unseemly wrangling which appeared to be going on amongst the board," the motion as proposed by Mr. A. Turnour, and seconded by Mr. Francis, for the re-election of the retiring directors, was carried.

County of London Electric Supply Co., Ltd.

Mr. J. B. Braithwaite (chairman) presided on Monday at Winchester House, E.C., over the sixteenth ordinary general meeting of the above company.

In moving the adoption of the report (see Electrical Review, page 400), the Chairman said it would be seen from the balance-sheet that considerable changes had been made in the capital account. During the year they had issued the balance of the last issue of preference shares, raising the amount now outstanding to £558,000, as against £500,260. During the year they had received the concurrence of the first and second debenture-holders, to raise their amount in each case from £400,000 to £500,000, and of that £100,000 increase in each case, they had issued £50,000 4½ per cent. first debentures, raising them from £400,000 to £450,000, and £50,000 4½ per cent. second debentures, thus again increasing the amount from £400,000 to £450,000. They would see that they had £150,000 additional capital during the year. That sum had been principally applied to meeting the capital expenditure—approximately £60,000—and the balance had been used for paying off a portion of the loan due to the bank, which last year amounted to £119,500, and which now stood at £50,000, a reduction of £69,500. That left them for further capital expenditure, £50,000 first debenture stock, and an equal amount of second debenture stock, and, of course, they had several other resources, such as additional preference and ordinary shares if they were required. On the other side of the balance-sheet, there had been an increase in capital expenditure, the bulk of which had gone in the extension of mains. The capital expenditure now stood on the London area at £1,703,598, whilst the capital expended during the past year in the London area was £57,026. As he had mentioned on previous occasions, the greater proportion of their capital expenditure was for the laying of mains, and out of that sum of £57,000 no less than £35,728 was for that purpose—that was nearly 60 per cent. of the total. It was not necessary to put in any additional generating machinery, but they had installed additional transformers and motors for supplying customers, and switchboards, instruments, and generally miscellaneous plant had absorbed between them a little over £15,000, and other items, such as slot meters and rental wiring, had absorbed £7,487. In previous years he had called attention to the gradual decrease in the capital expenditure, and that was continuing. They had a supply of generating plant sufficient for their present needs, and probably for some little time to come, and the bulk of their expenditure for the current year would be in the direction of extending their mains. They had such a large area on the north side of the Thames, that he thought the extension of the mains would go on for many years. As they knew, however, it was the policy of the board not to lay down additional mains unless it was on the understanding that it would be fully justified by the demand for current. On that account, therefore, they could only hope that the expansion of the mains would continue for many years to come. The results shown in the revenue account were such as not to cause any dissatisfaction. They would remember that the introduction of the metallic-filament lamp caused a new element to enter into their calculations, and while they cordially welcomed the lamp as one of the means for cheapening the cost of electricity to the consumer, yet they recognised it would also ultimately tend to increase the sale of electricity. They were aware that during what might be called the transition period there might be a temporary falling off in the consumption of electricity, yet despite the fact they had during the past year, which was, he ventured to think, the worst part of the transition stage, come out with a larger profit than in the previous year, and their revenue had gone up. That was not the case with all electric supply companies. Their revenue had gone up from £158,755 to £161,988, and their meter rentals had gone up in proportion, so that their total revenue stood at £177,303, against £172,996; and they were able to retain the great bulk of the increase, for they were carrying to the net revenue account £101,727, as against £101,037. In other words, they actually retained £3,327 as net profit. That was again due to the engineering and the technical staff for still further reducing the works costs, although, as he had pointed out before, that could not go on indefinitely. Their coal costs this year were 33d. per unit, which he thought they would agree with him was satisfactory, for it really meant that although they had generated a considerably larger number of units, their actual generating expenses were practically stationary. The net result was that they put £16,000 to depreciation, wrote off between £4,000 and £5,000 for various suspense accounts, and, after declaring the same dividend, carried nearly as much forward as before. Naturally, they would ask what were their prospects for the coming year? He was always loth to prophesy, but at the same time they had gone into the matter very carefully, and now they had got through the worst of the transfer to the metal filament-lamp, he thought they were justified in looking for something like their normal increase in revenue re-asserting itself in the coming year. With regard to the summary of results and their actual progress, they had every reason to be satisfied. The total applications received during the past year amounted to the equivalent of 1,192,583—30-kw. lamps (35,777 kw.), being an increase of 3,221 kw., or 28 per cent. That was an absolute record in the history of the company. They had had an increase in their customers of 1,581, who now amounted to the substantial figure of 15,138. The total number of units sold was 14,736,109, as against 13,610,760, an increase which was equal to over 8 per cent. The profits from their London station amounted to £122,576, as against £115,095, an increase of over 6½ per cent. On the other hand, the coal costs showed a reduction of 14½ per cent., and their total costs, including repairs, were about ¾d. per unit. So far as the current year was concerned, the indications were all favourable, and there was a considerable increase in units sold over the corresponding month of last year. He need hardly warn them not to expect an increase in their dividends, because, as he had told them several times, the amount they had transferred to the depreciation fund was not what it should be by a great deal, and the first of the improvement of the profits would go to strengthen their reserves. He would certainly like an increase in their profits, which would enable them to add a considerable amount to the £16,000 they were now putting to depreciation. With regard to other companies in which they were interested, the Bournemouth and Poole Co. continued to do well, and the Richmond Co. also continued to do very well. Up in the North, at Coatbridge, they had seen a considerable expansion of the business—they sold something like half-a-million units last year, and they had had a considerable addition of power consumers in that district. At Croydon (Rural) they were making the same progress, having about trebled their output, and they were getting an additional number of customers in the district, which was a growing one, and they hoped it would go on for a considerable time.

Mr. J. Shaw seconded the motion.

Mr. Lighton characterised the report as being not a bad one, but at the same time not a particularly good one. He paid a premium for his shares, and therefore 5 per cent. did not exalt him. At the same time he agreed that the board would do right to materially increase the reserve fund before paying more dividend on the ordinary shares.

The Chairman said that the mortgage in the accounts was on the Coatbridge business. That company was in a more fortunate position than some of the other companies with regard to the metallic-filament lamp. Roughly speaking, half their output was supplied for power purposes, which was not affected by the new lamp, and the increase in their power about neutralised any temporary falling off in the units supplied for light.

The report was then adopted, and the retiring directors, Mr. J. Shaw and Mr. F. E. Savory were re-elected directors.

The Chairman proposed a hearty vote of thanks to the commercial and technical staff, and referred in eulogistic terms to the work of the engineering staff.

Mr. Lighton seconded the motion, and it was carried.

Richmond (Surrey) Electric Light and Power Co., Ltd.—A dividend of 6 per cent. on the ordinary shares for the year 1909 has been declared.

Madras Electric Tramways (1904), Ltd.—The directors have declared a dividend of 1 per cent. (1s. per share) on the deferred shares and at the rate of 4½ per cent. per annum, in addition to ¾ per cent. actual, on the preferred ordinary shares, making 5¼ per cent. for the year to December 31st. £3,000 is transferred to depreciation and renewal fund, and £663 is carried forward.

Gandy Belt Manufacturing Co., Ltd.—The report states that, including £1,201 brought forward, the profit for the year to December 31st was £13,639. A final dividend of 5 per cent., making 8 per cent. for the year, is recommended, carrying forward £1,162.

Belgium.—The balance-sheet of the Société Bruxelloise d'Electricité, of Brussels, for the last financial year, shows a profit of £2,088, as compared with only £180 in the preceding 12 months

South Metropolitan Electric Light and Power Co., Ltd.—The debenture stock register and register of transfers will be closed from March 18th to 31st, 1910 (both days inclusive) for preparation of warrants for half-yearly interest at the rate of 4½ per annum payable April 1st, 1910.

Prospectuses.—*New York Telephone Co.*—There has been offering by Barings this week a second issue of £5,000,000 4½ per cent. first and general mortgage 30-year bonds at £97 10s. per cent. Half the total were reserved for London, £500,000 for Amsterdam and $10,000,000 for the United States.

Vera Cruz Electric Light, Power and Traction Co., Ltd.—This Mexican company is offering until to-day (Friday) £250,000 5 per cent. first mortgage debentures at 91½ per cent.

Metropolitan Electric Tramways, Ltd.—An issue of £250,000 5 per cent. debenture stock for the purpose of discharging temporary loans, equipping further lines, and for other purposes, is being offered at 91. The list is to close on Monday.

The Mirrlees Watson Co., Ltd.—The annual meeting of this company was held at Glasgow on March 8th. The accounts showed a profit on the trading account of £24,530, and after providing £3,521 for depreciation and for interest and directors' fees, a balance of £18,802 remained, which the meeting resolved should be applied as to £9,375 in payment of dividend of 7½ per cent. on the share capital, free of income-tax, as to £5,000 in providing for new tools, and as to £4,000 by transference to general reserve fund, the balance of £1,677 (including £1,250 brought in from last year) being carried forward.

Salisbury Electric Light and Supply Co., Ltd

In their report for the year ended December 31st, 1909, the directors state that the generating plant has been sufficient to meet the output, and the whole of the plant is in thorough working order and capable of dealing with a considerably increased demand. The profit on the year's working, including £299 brought forward from last account, amounts to £6,039, and after paying £1,431 interest on debentures, and an interim dividend at the rate of 4 per cent. for the half year, amounting to £700, there remains a balance of £3,908 to be dealt with. The directors recommend that a further dividend at the rate of 7 per cent. for the half-year be paid, making with the interim dividend, 5½ per cent. for the year, and that £2,400 be carried to reserve, leaving £283 to be carried forward.

	1908.	1909.
Units generated	617,495	630,618
Quantity sold—Public lamps	10,200	10,200
Private consumers by meter	502.846	513,843
Total sold	513,046	524,043
Used on works..	56,366	53,848
Total used	569 412	577,891
Expended in distribution	48,083	52,727
Public lamps	33	33
Total maximum supply demanded, kw.	314	332

Brompton and Kensington Electricity Supply Co., Ltd.

The directors' report for the year ended December 31st, 1909, states that the revenue account shows a credit balance of £27,081, which, with the balance of £9,400 brought forward, and £622 balance of interest received and accrued, makes a total of £37,103. After deducting £1,671 for interim dividend on the 7 per cent. cumulative preference shares, and £6 851 interim dividend at the rate of 9 per cent. per annum for the half-year to June 30th, on the ordinary shares, the directors recommend that the sum remaining, viz., £28,581, be dealt with as follows:—To depreciation account (making this fund £80,000) £3,605; to dividend on the preference shares for half-year ended December 31st. £1,671; to dividend on the ordinary shares for half-year ended December 31st at the rate of 11 per cent. per annum, making 10 per cent. for the year, £8,373; to reserve fund account, £6,000; to directors' additional remuneration, £410; leaving, to be carried forward, £8,521.

The following table shows the progress of the company's business:—

	35-watt lamps connected.	Inc. in 35-watt lamps.	Customers connected.	Gross receipts.	Expenditure.	Net receipts.	Aver. price per unit.	Div. on ord. shares.
				£	£	£	d.	
1907 ..	213,916	11,160	4,362	55,633	23,915	31,718	4·22	10%
1908 ..	224,826	10,910	4,598	53,118	25,318	27,794	4·17	10%
1909 ..	235,802	10,976	4,883	50,790	23,709	27,080	4·18	10%

The annual meeting was held on Wednesday. Our report thereof will appear next week.

British Insulated and Helsby Cables, Ltd.

The directors' report for the year ended December 31st, 1909, states that the profit amounts to £131,767 plus £51,004 brought forward, making £182,771. From this have to be deducted:—Directors' and debenture trustees' fees, and remuneration to works' committee, less directors' fees receivable from other companies, £4,502; interest on debenture stock, £22,500; depreciation on buildings, plant, machinery, &c., £20,000; transfer to special reserve account, £8,500; transfer to debenture stock redemption account, £5,000; dividend on preference shares to December 31st, 1909, £30,000; interim dividend on ordinary shares to June 30th, 1909, £20,000 = £110,502, leaving available for dividend a balance of £72,269. The directors recommend the payment of a further dividend of 6s. per share on the ordinary shares, making with the interim dividend already paid a total of 10 per cent. for the year ended December 31st, 1909, £30,000, carrying forward, £42,269. The volume of trade during the past year has been less than in 1908, especially in the manufacture of heavy cable, a result largely due to the increased use of metallic-filament lamps, and the falling off in the construction of electric tramways and other work. It is, however, satisfactory to be able to say that the volume of business done so far this year is larger, and orders in hand at present compare favourably with the corresponding period of last year. A sum of £8 500 has been transferred to special reserve account, a further £5,000 to debenture stock redemption account, £20,000 depreciation on buildings, plant and machinery, and the amount carried forward is £42,269.

Newcastle-upon-Tyne Electric Supply Co., Ltd.

The directors' report for the year ending December 31st, 1909, to be presented at the annual meeting on March 21st, states that the connections to the company's system at the end of the year amounted to 129,219 h.p., which, compared with the previous year's figure of 111,484 h.p., show an increase of 17,735 h.p. The profit for the year, including the balance of £2,736 brought forward, amounts to £104,888, against £75,087 in 1808, against which has been charged interest on debentures, loans, &c., amounting to £23,589, leaving an available balance of £81,299 (as compared with £49,148 in 1908). The directors recommend a dividend of 5 per cent. for the year on the preference shares (interim dividend of 2½ per cent. already paid) £34,375, a dividend of 4 per cent. for the year on the ordinary shares £27,500 (against 2½ per cent. or £13,804 last year), transferring to depreciation account £16,500 (against £5,000) carrying forward to 1910 £2,924 (against £2,736). The reserve account at December 31st, 1908, stood at £16,989, from which has been deducted the cost of conversion of first and second mortgage debentures and the issue of new debenture stock (referred to hereafter) amounting to £9,995, leaving at the credit of reserve account £6,994. The general depreciation account, which at the end of 1908 stood at £83,500, will be increased by the proposed transfer of £16,500, to £100,000. This is in addition to the £150,000 written off in 1906 in reduction of capital expenditure. The business of the company for the year has suffered by the general depression in trade. The expenditure on capital account during the year amounted to £145,902, and has been mainly in connection with the new power station at Dunston. This station is now nearing completion, and will be in operation during the course of the current year. During the year £687,500 4½ per cent. consolidated first mortgage debenture stock, secured by a trust deed, has been created, and £210,600 4 per cent. first mortgage debentures and £159,400 4½ per cent. second mortgage debentures have, by agreement with the holders, been converted into this debenture stock, leaving £39,400 first and £29,600 second mortgage debentures which fall due for repayment, or conversion into new stock, on January 1st, 1912. £248,500 of the new stock was offered and subscribed for in cash, the total amount of new stock issued being £618,500, leaving debenture stock unissued amounting to £69,000, which represents the total of the said two sums of £39,400 and £29,600.

Oxford Electric Co., Ltd.

Sir Henry Mance presided at the annual meeting held at Oxford on March 4th. In moving the adoption of the report (see Electrical Review, page 355), he said that they had built two additional sub-stations during the year, and had interpoled one of their largest units at the works, thereby largely increasing its capacity. The principal increase in capital expenditure was on account of mains. The preference shares offered during the year were over-applied for nearly three times. Generating and maintenance costs were less than in the previous year. Their revenue had improved, in spite of metallic-filament lamps. They had added during the year the equivalent of 10,615 30-watt lamps. The year was not a record in large additions, but it was above the average. Many companies had been experiencing decreases in their revenue, but that of this company had slightly exceeded that of the preceding year. For the last two or three years they had been marking time, but since they started 18 years ago they had never looked back. The great number of new lamps added had more than compensated for the economy of old customers using wire lamps. They had added 185 new consumers, which was 13 more than in the previous year. The hire-purchase system continued to be popular, and had added over a thousand lights. The Corporation's street lighting contract with them had been extended for another four years, and some of the latest arc lamps were to be introduced. The chairman proceeded to allude to the advantages of electric heating. Though they had generated 60,000 more units, their coal bill was reduced, partly because of the lower price of coal, and partly because of the efficiency of the steam plant. They had heard nothing as regards electric tramways running soon, though there had been a suggestion made that self-contained trams should be run.

Sir Irving Courtenay, in seconding, said that considering the changes that the electrical industry was passing through, they might congratulate themselves that the company was able to pay the same dividend as before without any difficulty, after placing the usual amount to reserve.

The report was adopted.

Scarborough Electric Supply Co., Ltd.—The directors' report, which is to be presented to the meeting to-day, Friday, states that the amount of energy supplied during the year ended December, 1909, has increased to 846,022 units, as against 837,835 units for the year 1908, but the receipts have fallen owing to the reduced net price obtained per unit. This is mainly due to the greatly increased use of the new metallic-filament lamps, which have reduced the number of units sold at the higher rates. The consequent cheapening of the electric light has, however, been the means of bringing on a number of new consumers. The accounts show that, after placing the sum of £1,500 to depreciation account, there is a balance on revenue account of £3,851. The directors recommend that a dividend be paid, free of income-tax, at the rate of 3 per cent. for the year, which will absorb £3,000, leaving a balance of £851 to be carried forward.

Bastian Meter Co., Ltd.—The report of the directors, which was presented at the twelfth annual meeting, held on March 10th at the Inns of Court Hotel, London, states that the result of the year's trading shows an increase as compared with last year. The directors having written off patents and goodwill the sum of £870, the net amount of profit is £323, to which has been added the balance brought forward from 1908 of £582, less £121 paid on June 30th, 1909, for 6 per cent. cumulative preference dividend to December 31st, 1908, making £798. The directors now recommend the payment of the 6 per cent. dividend on the cumulative preference shares and also a 2½ per cent. dividend on the ordinary shares for the year ending December 31st, 1909, which together will absorb £369, and that the balance, £415, be carried forward. The report was adopted by the meeting.

Bournemouth and Poole Electricity Supply Co., Ltd.

The directors report that the capital expended during the year ended December 31st, 1909, on account of the Bournemouth Order, 1890; the Poole and Branksome Order, 1897; the Christchurch and District Order, 1899; and the Pokesdown Order, 1902, amounted to £10,701, making the total expenditure on account of these orders up to December 31st last £443,200. The revenue balance brought forward from 1909 was £913, and the balance from the Revenue Account No. II, for 1909, after deducting generation and distribution costs, rent, rates, taxes, wages, directors' fees, general establishment and other charges, and proportion of salaries, is £33,806, making a total available revenue of £34,719. From this are deducted—Interest on debenture stock and temporary loans, less income-tax, £8,291; interim dividends on 4½ per cent. and 6 per cent. preference shares for June half-year, less income-tax, £5,852; interim dividend on ordinary shares at 5 per cent. per annum for June half-year, less income-tax, £3,547; leasehold and special redemption funds and interest, £1,567; amount written off suspense accounts, £320; amount carried to reserve for depreciation, repairs, renewals, &c., £4,000; leaving for distribution, £11,141. The directors now recommend that the final preference dividends be confirmed, and that a final dividend on the 15,000 ordinary shares for the half-year ended December 31st, 1909, at the rate of 6 per cent. per annum, less income-tax, be declared. There will then remain a balance of £1,077 to be carried forward. The total applications received at December 31st last amounted to the equivalent of 223,156 30-watt lamps (6,694 kw.), being an increase of 16,971 (509 kw.) for the year. The total number of units sold for all purposes was 2,973,487. The Richmond (Surrey) Electric Light and Power Co., Ltd., has declared a dividend of 6 per cent. on its ordinary shares for the year 1909.

Units generated	3,747,556
Units sold—Public lamps	23,050
Private consumers by meter	2,950,437
Total sold	2,973,487
Used on works	400,048
Total accounted for	3,373,535
Not accounted for	373,021
No. of public lamps	129
Total maximum supply demanded, kw.	2,281

The meeting was held yesterday at Moorgate Court, E.C.

Winchester Electric Light and Power Co., Ltd.

The directors' report for the year ending December 31st, 1909, states that the progress which the company is making continues to be satisfactory; the equivalent of 2,012 8-c.p. lamps have been added, making the total connection 58,653 8 c.p. lamps. Including £279 brought forward from last year's account, the statement shows a net profit of £7,199, which, after payment of debenture interest, £2,050, leaves £5,149 available for distribution. An interim dividend for the half-year at the rate of 5 per cent. per annum, amounting to £1,105, was paid in September last, and the directors now recommend that a dividend at the rate of 7 per cent. per annum be declared for the half-year, which will absorb £1,547, making 6 per cent. for the year; that £1,000 be placed to depreciation fund account, and that £1,200 be placed to reserve fund account, leaving a balance of £298 to be carried forward. The works and mains are in good working order. Notice of the intention of the Corporation of Winchester to exercise their power of compulsory purchase of the undertaking at the expiration of 12 calendar months from January 20th, 1910, has been received. Mr. F. E. Gripper and Captain Clayton Mitchell, R.N., offer themselves for re-election as directors.

Units generated	640,320
Total units sold: private consumers by meter	511,812
Used on works and loss in mains	103 618
Quantity not accounted for	24,890
Total max. supply demanded, kw.	425

Chelsea Electricity Supply Co., Ltd.

Sir Irving Courtenay presided on Wednesday over the annual general meeting of this company held at Winchester House.

The Chairman, in moving the adoption of the report (see Electrical Review, page 354), said he was glad to be able to say that, notwithstanding the difficulties through which they were passing, and although they were recommending only the same dividend as in the previous year—namely, 4½ per cent.—the accounts for the year 1909 showed a decided improvement on those for 1908. The gross revenue was larger and the expenses were only a little more, while the costs per unit came out at a slightly lower figure. The price obtained per unit was, however, somewhat less. This result was attained partly by the cheaper price of coal, the total expenditure on coal being £722 less, although 151,758 more units were sold; but was counterbalanced to some extent by an increase in the cost of maintenance of plant, which, though it had been maintained in an efficient and reliable working condition, as it became older had a tendency to cost more for the maintenance and renewal of the working parts. The number of lamps added to the circuits increased each year, but the results obtained formerly by such additions were partially neutralised by the gradual substitution of metallic-filament lamps on the older installations. The detriment, however, arising from this was again modified by the fact that, the new lamps requiring less current, they did not need to add to their machinery, and the increase in capital expenditure on plant was consequently small, and could be met without fresh issue of capital. The building trade had remained in a quiet condition throughout the year, and the development of building estates in Chelsea had only progressed to a small extent. It was, therefore, satisfactory to find that, notwithstanding these adverse conditions, the rate of connecting on new supplies had been well maintained. The total number of units sold during the year was 3,806,366. It was not possible to forecast with accuracy the ultimate effect on their revenue of the introduction of the metallic-filament lamps. They were still coming into use in their district to an increasing extent, and in all cases where they were suitable for use they were giving satisfaction to their customers. Although in the case of many customers this might lead for the time to important reductions in their electric lighting account, they believed that in the long run the change would operate to the benefit of the business. In the first place, many customers, being better satisfied with the amount of light obtained at a reduced cost, would use the current more freely, and would accustom themselves to a better standard of lighting. Instead, therefore, of taking to themselves all the advantage of the reduction in cost, they would expect more light and use it accordingly. Hotels, shops, public halls, and the like, would certainly improve their lighting by using more powerful lamps, and they had most of them already done so to a great extent, with the result that the falling-off in revenue was not so much as might have been anticipated when these new lamps were first put on the market. No doubt there were still a large number of customers who would further avail themselves of the new lamps; but they believed they could look forward to the future without grave concern, especially as they hoped that the economy of these lamps would induce a considerable number of the smaller houses and shops not at present wired to become users of electric light. They recognised the importance of encouraging in every possible way the use of the electric current for purposes other than for lighting—that was for motive power, heating, cooking, ventilating, charging electric batteries, &c. In a residential district such as Chelsea there was necessarily not a large demand for current for motive power purposes, as was the case in districts where there were many factories and workshops. Nevertheless, they had made further progress in the sale of energy for purposes other than lighting. Reviewing the whole situation, it behoved them to adhere to their conservative policy in regard to the depreciation fund, which was the only general reserve fund in their accounts. There had appeared in the Press, particularly in the technical journals, a good deal of correspondence relating to improved and cheaper modes of wiring, and no doubt, in time, some results in that direction would be obtained. In view of this, and of the fact that the cost of electric lighting by means of these new lamps was sufficiently low to compete with gas, it was to be expected that from these causes also the area of their business would eventually extend to include the smaller class of premises still unwired. He mentioned to them last year that an Act had been passed which, among other provisions, permitted the association of supply undertakings for the purposes of economy in production. During the year conferences had been held between the companies and the municipalities with the object of profiting by the provisions of that Act, and it was hoped that a favourable issue would be arrived at before long. If, as they hoped, such combination should result in enabling them to obtain a supply of energy in bulk at a reasonable price, it would obviate much capital expenditure in additional machinery. The Board of Trade had also obtained their long-deferred Act—the Electric Lighting Act, 1909; but that only slightly affected this company, as its most beneficial provisions had already been obtained by the London Electric Supply Act, 1908, to which he had just referred. In regard to the capital expenditure, this had been incurred chiefly in mains and meters, with a certain amount on generating plant, two old generators having been replaced by two of a more economical type. Their financial position was very sound. The investments had been increased from £14,800 to £22,000. They were carrying forward a slightly increased amount and keeping their reserve funds up to a reasonable level, and when the disturbance caused by the new lamps had settled down, he could at present see no reason why they might not hope in the near future to increase their earnings sufficiently to pay somewhat increased dividends without any fear of going back.

Major W. F. Woods, J.P., seconded the motion.

Mr. Tuckett drew attention to the way in which the accounts were made up, in respect of deducting the reserve and depreciation fund from the amount of capital expenditure, and expressed the opinion that in view of possible future purchase of the company by a local authority, it was undesirable to give an arbitrator a handle to argue that the company recognised that the renewals and depreciation fund represented depreciation actually incurred. He was pleased to hear that the introduction of the metallic-filament lamp would raise the standard of lighting in the smaller houses, and suggested that it would be as well for the company to educate people to the use of electricity.

Mr. Metcalf remarked that he thought they would have seen the end of Parliamentary expenses last year, but he saw the item occurred again. He wondered whether it might not be possible for the company to invest in their own debentures, and thus save the payment of the premiums when they became due.

The Chairman, in reply, said that the way in which they drew up their accounts was in the Board of Trade form. He assumed it would be possible for them to alter it, if it was considered desirable. The matter would have the attention of the board. As to the use of a showroom, they might be able to enlarge their offices and utilise a portion of them for the purpose of exhibiting electrical apparatus. In answer to Mr. Metcalf's criticisms as to the

law charges, that item was the balance of their Parliamentary expenses, and he hoped they had come to an end. In reference to increasing the dividend, he would always be ready, if he could, to meet the shareholders in that direction. He recognised how patient they had been, but he did not think the shareholders desired the directors to deal or tamper in any way with what they had put aside for reserve for the purpose of increasing the dividend.

The report was adopted.

Hove Electric Lighting Co., Ltd.

The directors report that the gross revenue for the year ended December 31st, 1909, shows an increase of £510, while the costs have decreased by £8, the net result of the year's working being a profit of £13,981, compared with £13,463 in the preceding year.

Year.	Houses.	Equiv. in 8-c.p. lamps.	Units sold.	Gross revenue.	Net revenue.
1907 ..	1,579	104,893	1,019,469	£23,321	£12,693
1908 ..	1,670	114,135	1,134,994	24,695	13 463
1909 ..	1,820	122,946	1,192,508	25,205	13,981

To the net profit, £13,981, there is added £292 brought forward, making a total of £14,273. The half-yearly preference dividends, due on March 1st and September 1st last, have been paid, together with an interim dividend on the ordinary shares, at the rate of 8 per cent. per annum, in October last. After deducting these amounts, together with the accrued debenture interest, and provision for income-tax, there remains an available surplus of £8,413. The directors propose to place £1,500 to the renewals and depreciation account, and £2,500 to the sinking fund; to set aside a sum of £589 for the accrued preference dividend to December 31st last, and to declare a final dividend on the ordinary shares, payable on April 15th, at the rate of 9 per cent per annum, making 8½ per cent. for the year. This will leave £363 to be carried forward, after providing for the extra remuneration to the directors. The renewals and depreciation account, with the above addition, will now stand at £22,604. The sinking fund account, with the above addition of £2,500 and £1,273 received by way of dividends on investments, will now amount to £34,845. The machinery, buildings and mains of the company have been kept in good repair. The expenditure during the year on capital account has amounted to £1,941, the greater portion of which has been incurred in extensions of mains and in additional meters.

Mr. Carleton F. Tufnell (chairman) presided on Thursday last week at Salisbury House, E.C., over the eighteenth annual general meeting of the company.

The Chairman, in moving the adoption of the above report, said the year had been an uneventful one for the company, the only feature perhaps being the regretted loss of the Brighton omnibus load, which he foreshadowed at the meeting last year, the Brighton Corporation having stipulated for the supply of current to the 'buses in return for the licence granted to them to ply within their area. That loss took place as from May last, and he thought it was satisfactory that notwithstanding that loss they were able to show an increased profit of £510. At December 31st, 1909, they had 1,820 houses connected to their mains, as against 1,676 at the end of 1908. Eliminating about 50 per cent. of the remaining houses, which were in the back part of the town, where there was not likely to be much demand for current, there was a balance of 3,222 houses, of which only 1,820 were now being supplied, so there was a considerable outlook for additional houses in the future. The number of lamps added to the system during the year was 8,811, compared with 6 169 in 1907 and 9 742 in 1908. The increase of units in 1909, compared with 1908, was 57,514; as against an increase of 115,525 units in 1908 over 1907. It would be observed that the increased consumption did not equal the percentage of increased connections of lamps; in other words, while the lamp connections were increasing in a fairly satisfactory manner, the number of units consumed per lamp fixed was falling off. In common with all other supply companies, they had again suffered from the recent introduction of metallic-filament lamps. Seeing that they were essentially a lighting company, and that the proportion of current supplied for power purposes was very small in such a residential area as Hove, he feared they must expect to suffer for a short time yet from this cause. Indeed, he had but little doubt that the present, and perhaps next year, would see a still further diminution in the units sold per lamp connected, notwithstanding the constant steady increase in new consumers, and even of sale of energy. He was afraid they had not yet struck rock-bottom in this respect, but he trusted they would soon do so, and there was no doubt whatever that eventually they would look upon the new lamps as one of their best allies in competition with gas. The result of cheapening the electricity by the use of lamps which took less current than the old carbon-filament lamps, must be to increase the number of lamps put up in houses. Lamps would be fixed in places where, when the cost was higher, it was decided to do without light or to retain gas. Consequently there should be a considerable and steady increase in the number of lamps connected, while at the same time, the feeders and mains laid would suffice for a much larger number of lamps than under the old carbon lamp system, because each metallic-filament lamp fixed took less current. They had spent during the year £1,299 on mains, including cost of laying; and £458 on meters. While a larger quantity of current was generated, the cost of generation had been reduced from £6,332 to £6 319. £1,533 had been expended on repairs and maintenance, as compared with £1,749 in 1908. In this connection, he observed recently, in the report of the proceedings of a supply company somewhat similar to their own, that one of the shareholders strongly animadverted on the fact that all the machinery was of foreign make. They were not open to the same criticism, all their plant having been supplied by Messrs. Crompton & Co., Ltd., and manufactured in this country. The net result of the year's working was a profit of £13,981, compared with £13,463 in the preceding year.

Colonel H. Wood seconded the motion, which was carried without discussion.

Mr. F. R. Reeves (managing director) moved a cordial vote of thanks to Mr. Smith, the resident engineer, and his staff at Hove for their services during the year, and this was seconded by Colonel H. Wood and carried.

Metropolitan Electric Supply Co., Ltd.

The twenty-third ordinary general meeting of this company was held on the 8th inst. at Winchester House, Mr. W. Harrison Cripps presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 353), said they had had the smallest capital expenditure of any one year since the company commenced. The revenue for 1908 was £180,672, whilst last year it was £174,367, a decrease of £6,301. The working costs which in 1908 were £80,697, this year stood at £79,847, a reduction of £850. He did not think he could congratulate the shareholders on the great prosperity of the company, for the year had not been an especially prosperous one for them. That was shown by the diminution of nearly £6,000 in their revenue, although against that they had a certain small saving in the expenses. There were two or three minor causes to which the decrease could be attributed, but they had thoroughly thrashed out the whole matter, and the directors considered that it was largely due to the increased use of the metallic-filament lamp. Light was one of the secrets of health, and he would say that a bright light in a house was one of the elements of health. Scientific progress had shown them that special forms of diseases were more or less cured by a bright light, so much so that the heads of families paid on behalf of their families for them to be treated by the X-rays, the Finsen light, and the Röntgen rays, for the purpose of having strong rays of light penetrating their bodies, and curing certain germs. Surely it was much better to have brightly lighted houses, so that the germs could not exist at all. He, therefore, said it was not good economy to starve the light in a house, especially when they could get three times the amount of light for the same amount of money as before. They were not the only company who had suffered—in fact, all of them had suffered this year, although, perhaps, they showed it more strongly. With a view of encouraging the use of electric light for heating and cooking purposes, they had this year opened a shop in Paddington where electrical appliances of different kinds were being exhibited. He believed that it was with the cooking apparatus that the great prosperity of their company lay in the future. The shareholders would remember that some time ago the company sought powers to enter into the western part of Middlesex. One of the objects of that scheme was in order to get a different load to that which they were used to in London. They had now got the final sanction of the Board of Trade to go on with the work. The contracts had been given out for the laying of the mains in Southall and Hanwell, and they hoped to be able to give a supply in the early autumn. They had already got a good many contracts to supply factories along the Great Western line between Acton and West Drayton. The scheme would, of course, cost money, and they reckoned they would require about £50,000 to complete everything and get a supply into Hanwell and Southall. The money would be spread over about two years. The directors considered it would be well spent, because it would be connecting up customers with their Willesden station. They had many thousands of kilowatts at that station lying idle and that could be put into use. As to how the money would be raised, the shareholders would remember that some time ago they authorised the board to issue some preference shares. They had got a considerable amount of them, and it might be necessary to issue a further portion of them. Since their last meeting they had lost the services of Mr. Conacher, their general manager, and he was sure they all wished him success in his new sphere of business. The post of general manager and engineer was now held by Mr. Highfield.

Sir James Pender seconded the motion.

Replying to a discussion, the Chairman said that the directors had been very carefully considering a scheme whereby a person could take a supply of electricity and use it for any purposes. Their lighting connection for the first nine weeks of this year, compared with the same period last year, amounted to 9,000 and 7,000 respectively.

The report was adopted.

Canada.—A Canadian correspondent writes: "Ottawa Electric Railway stock is probably the most valuable stock to-day in Canada, and is not for sale under any circumstances. This stock, a few years ago, went a-begging for purchasers at $30 to $60 per share. The directors were forced to hawk the stock round among their moneyed friends and almost beg them to buy. Now there are the regrets. This stock cannot be purchased—it is not on the market at all—for $275 to $300 per share. At the annual meeting of the shareholders recently a profit of 17 per cent. on the year's transactions was shown. The usual dividend of 12 per cent. was declared, and while liberally providing for renewal of capital in rolling stock, &c., a large amount was placed to the reserve."

MARKET QUOTATIONS.

Wednesday, March 16th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	29/-	..
a „ Oxalic	„	28/-	..
a „ Sulphuric	„	5/6	..
a Ammoniac, Sal	„	42/-	..
a Ammonia, Muriate (crystal)	per ton	£29	..
a „ „	„	£30	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16	..
a Ferro-Silicon (50 %)	„	£10	10/- dec.
a Copper Sulphate	„	£19	..
a Lead, Nitrate	„	£26	£1 dec.
a „ White Sugar	„	£23 10	..
a „ Peroxide	„	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	4½d.	½d. inc.
a Potassium, Cyanide	„	7d.	..
a Shellac	per cwt.	75/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70 %)	„	£11	..
a „ Chlorate	per lb.	3½d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a „ Cyanide (basis 100 %)	„	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£75	..
b „ Wire, in ton lots	„	£112	..
b „ Sheet, in ton lots	„	£120	..
p Babbitt's metal ingots	„	£33 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7⅞d.	..
c „ Tube (brazed)	„	9¼d.	..
c „ „ (solid drawn)	„	7⅞d.	..
c „ Wire, basis	„	6⅝d.	..
c Copper Tubes (brazed)	„	9¼d.	..
c „ „ (solid drawn	„	9d.	..
g „ Bars (best selected)	per ton	£73	..
g „ Sheet	„	£73	£1 dec.
g „ Rod	„	£73	£1 inc.
e „ (Electrolytic) Bars	„	£62	10/- dec.
e „ „ Sheets	„	£78 5	5/- dec.
e „ „ Rod	„	£66 15	5/- dec.
e „ „ H.C. Wire	per lb.	8d.	⅛d. dec.
f Ebonite Rod	„	3/3	..
f „ Sheet	„	3/-	..
n German Silver Wire	„	1/6	..
h Gutta-percha, fine	„	5/6 to 10/-	..
h India-rubber, Para fine	„	10/4½	1/5½ inc.
l Iron Pig (Cleveland warrants)	per ton	51/6	3d. inc.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Ingot	„	£13 10	dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£9 5	inc.
d Mica (in original cases) small	per lb.	6d. to 1s.	..
d „ „ „ medium	„	2/6 to 4/-	..
d „ „ „ large	„	4/6 to 8/6	..
p Phosphor Bronze, plain castings	„	11d.	..
p „ „ rolled bars & rods	„	1/8	..
p „ „ rolled strip & sheet	„	1/8	..
o Platinum	per oz.	120/-	variable.
c Silicium Bronze Wire	per lb.	9½d.	..
r Steel Magnet, in bars	per ton	£65	..
g Tin, Block (English)	„	£143 to £144	£4 dec.
n „ Wire, Nos. 1 to 16	per lb.	1/9	¼d. dec.
p White Anti-friction Metals:—			
"Ibis" brand	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£26 15	15/- dec.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd
p London Phosphor Copper & Bronze Co., Ltd.
r W. F. Dennis & Co.

Alley & Maclellan, Ltd.—The directors report that the accounts for the year to December 31st shows a debit balance of £4,010, which is carried forward, after writing off £3,139 for depreciation on buildings, plant, &c. The interim dividend on the preference shares paid on September 30th, has been debited to the reserve fund, reducing it to £712.

Rosario Electric Co., Ltd.—Interim dividend 3s. per share on the fully-paid ordinary shares for the half-year to December 31st.

Stock Exchange Notice.—Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

La Plata Electric Tramways Co.—170,000 6 per cent. cumulative preference shares of £1 each, 7s. 6d. paid.

Canadian General Electric Co., Ltd.—The directors have declared a dividend of 1¾ per cent. on the common stock for the three months to March 31st (7 per cent. per annum), and a dividend on the preference stock at the rate of 7 per cent. per annum, for the half-year to the 31st inst.

STOCKS AND SHARES.

Tuesday Night.

The expansion of general business is the most noticeable feature in the Stock Exchange. Notwithstanding the rise in money, which points to a possible early advance in the Bank Rate, nearly all the markets show pronounced animation, and public buying is present in every department of the House, with the exception of the Consol division, where the unsettlement of the political outlook blocks the way to business.

Rubber shares, while less wild than they were a fortnight ago, are still active and firm. The turnover during the first fortnight of March has been enormous, and the settlement this week forms a record one, as regards trade, in the Stock Exchange annals of the past eight years.

Were it possible to imagine any member of the Stock Exchange spending a strenuous day in the markets, concluding with high pressure of office work, the last train home, and the preparation of an electrical-financial article by way of a night-cap, the reader might perhaps feel no surprise if he detected an odour of lamp-oil in the paragraphs.

The Home Railway market is anything but sleepy. That spirit of speculation of which we wrote last week has worked its way round to Home Railway stocks, and a lively upward movement has set in, led by substantial gains in Brighton Deferred stock. It is said that the company is doing very well with its newly electrified section, and the traffics are held to encourage hopes of an increase in the next dividend. After the southern passenger stocks the Undergrounds attract most attention, and Metropolitan Consolidated followed up its rise of 3 last week with a further gain of 2¼ points, the coming Exhibition being still the basis upon which the improvement is grounded. Central Londons, now that the profit-takers are weeded out, exhibit renewed recovery, the Ordinary gaining 2 and the Deferred 1. The Preferred, which has not changed, may again be commended to the investor who likes Home Railway stocks, which offer a good rate of interest upon the money employed, with a fair prospect of improvement in capital value. City and South Londons have risen ½. Districts have hardened ⅜, and Baker Street and Waterloo 4 per cent. Debenture stock was bought at 97½ early this week.

Traction issues, as a whole, are strong. British Electric Preference came into demand, and rose 5s. London United Preference are ⅛ higher at 2½. The foreign group is good. Anglo-Argentine Second Preference went up ½, and the British Columbia Electric Railway stocks have improved in the Preferred and Deferred stocks. Mexico Trams are 1 better, and Rios are only a point below their par value. The solitary decline in the list is provided by Metropolitan and Electric Trams Preference which receded to 15s. middle.

In the search for good investment securities of the pre-Ordinary type the investor is wisely studying the attractions of certain of the Preference shares in the electric lighting list. The objection of many people to the purchase of electric lighting shares at the present time, is that the industry entered upon a new phase with the advent of the metal-filament lamp, and that they want to see how the invention will affect the companies before they put money into the shares. This argument carries little weight, however, as regards the Preference shares of the best lighting companies, and it many be useful again to tabulate a short list showing how such investments pay at the current levels. From the list on the next page but one we take the following selection as representative of their class:—

Company.	Preference div., p.c.	Price.	Yield, p.c.
Brompton	7	7⅞	4½
Charing Cross	4½	4½	5
City of London	6	12½	4¾
County of London	6	11½	5⅛
Metropolitan	4½	5	4½
St. James' and Pall Mall	7	7⅞	4½
Westminster	4½	5⅛	4½

Most of the shares in this list can be bought rather cheaper than the above prices show, sufficient to cover expenses of transfer and brokers' fees.

Telegraph and Telephone stocks and shares are mostly strong. The Anglo group and the Eastern division have healthy rises. Direct Spanish advanced, and Indo-European shares gained a further 10s. The Trust section has a rise of ½ in Commercial Cable Debenture. New York Telephone Debentures fell 1½ on the issue of the new stock, for which there was an eager demand, the lists closing in the course of two or three hours after they opened. A genuine premium of ⅜ per cent. has been established on the new scrip.

Bank Rate. — The Bank Rate was yesterday raised from 3 to 4 per cent.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1906.	1907.	1908.	1909.	Closing Quotations March 8th.	Closing Quotations March 15th.	Business done week ended March 15th, 1910. Highest	Lowest.	Rise + or Fall —	Present Yield per cent.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	3⅜ — 3¾	3⅜ — 3¾	..	..	..	Nil.
116,200	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	100 —102	100 —102	..	..	..	4 18 0
$235,196,000	American Telephone & Telegraph, Cap. Stock ..	$100	8 %	8 %	8 %	8 %	144 —146	144 —146	145	..	..	5 9 7
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	94 — 96	94 — 96	..	..	..	4 3 4
558,460	Anglo-American Telegraph	Stock	33⅞	34⅜	£3 4s.	38⅞	59 — 61	59½ — 61½	61	..	+ ⅜	6 1 0
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	102⅛—103⅜	102¼ —103¼	103	102	— ¼	p 16 3
3,220,770	Do. do. do. Deferred	Stock	12⅝	1 %	8/-	25/-	19⅛— 19⅝	19⅛— 19⅝	19 1/16	19 1/16	+ ⅛	6 7 0
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	99½—101½	99½—101½	..	..	..	4 18 6
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	7 15/16— 8 1/16	8 — 8⅛	8 1/16	8 1/16	+ ⅛	4 17 0
2,449,176	Commercial Cable, Sting. 500 year 4% Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	87 — 89	87½ — 89½	88½	87½	+ ½	4 9 5
15,000	Cuba Telegraph	10	5 %	6 %	6 %	..	8⅛ — 9¼	8⅛ — 9¼	..	..	..	6 9 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	16½ — 17½	16½ — 17½	..	..	..	5 12 8
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	..	8 — 8⅝	8 — 8⅝	63/9	..	..	5 3 3
6,000	Do. do. 10 % Cum. Pref. ..	10	10 %	10 %	10 %	10 %	8 — 8¼	8 — 8⅜	..	..	..	6 b 0
6,000	Do. do. 4½ % Debs.	50	4½ %	4½ %	4½ %	4½ %	100 —102	100 —102	..	..	..	4 8 4
80,000	Direct United States Cable	20	4⅜ %	4½ %	4½ %	..	13⅜ — 14½	13⅜ — 14½	14⅛	13⅞	..	5 19 1
69,710	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,309, R.	100	4½ %	4½ %	4½ %	4½ %	100 —102	100 —102	..	..	..	4 8 3
48,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	..	134½—137½	136 —139	138½	136	+ 1½	5 0 9
4,000,000	Do. 8½ % Pref. Stock..	100	8½ %	8½ %	8½ %	8½ %	86 — 88	86 — 88	88	..	..	4 1 5
2,000,000	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	102½—104½	102½—104½	104	102½	..	3 16 7
1,886,706	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	..	12⅝ — 13⅛	12⅝ — 13⅛	13 1/16	13	..	5 6 8
900,000	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
752,460	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 3
240,000‡	Globe Telegraph and Trust	10	5⅝ %	5⅞ %	5⅝ %	..	10½ — 11	10½ — 11	10⅝	10⅜	..	5 4 7
181,127	Do. do. 6 % Pref..	10	6 %	6 %	6 %	6 %	13⅛ — 13⅜	13⅛ — 13⅜	13⅜	13 1/16	..	4 7 3
181,127	Great Northern Telegraph, of Copenhagen.. ..	10	20 %	20 %	18 %	..	30½ — 31½	30½ — 31½	30⅝	30½	..	5 9 1
150,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
14,800	Indo-European Telegraph	25	13 %	13 %	13 %	..	53 — 55	53½ — 55½	..	..	+ ½	6 14 6
17,000	Mackay Companies Common	$100	8½%	4 %	4 %	4½%	92 — 94	93 — 95	..	..	+ 1	4 9 6
$41,360,400	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	80 — 83	79 — 83	80	..	+ 1	4 17 7
$50,000,000	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	3 1/16— 3 3/16	3 1/16— 3 3/16	13/9	..	..	Nil
894,190	Monte Video Telephone Co., Ltd. Ord.	1	6 %	6 %	6 %	..	⅞ — 1	⅞ — 1	..	..	..	6 0 0
72,680	Do. do. 5 % Pref.	1	5 %	5 %	5 %	5 %	1/16— ⅛	1/16— ⅛	17/-	..	..	5 6 8
66,492	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	104½—106	104½—106	105½	104½	..	5 13 2
2,225,000	Do. do. Def. Stock	100	5 %	6 %	6 %	6 %	123½—125½	123½—125½	125	123½	..	4 15 7
3,725,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	10⅜ — 10¾	10⅜ — 10¾	..	..	..	5 10 4
15,000	Do. do. 6 % Cum. 2nd Pref.	10	5 %	6 %	6 %	6 %	10 — 10¼	10 — 10¼	..	..	..	5 11 8
15,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	5 1/16	5⅛	..	4 8 11
250,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	98 —100	100	..	..	3 10 0
2,000,000	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
1,988,598	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	8 %	8 %	..	1½ — 1⅝	1½ — 1⅝	..	..	..	5 6 1
179,318	Do. do. do. 6 % Cum. Pref.. ..	1	6 %	6 %	6 %	6 %	1 1/16— 1 1/8	1 1/16— 1 1/8	..	..	..	4 14 9
50,000	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	86 — 88	86 — 88	..	..	..	4 10 11
195,255	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	98 —100	98 —100	..	..	..	4 0 0
29,400	Reuter's	8	5 %	5 %	5 %	..	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	4 18 9
11,839	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 8
145,955	Submarine Cables Trust	Cert.	6 %	6 %	6 %	..	130 —133	130 —133	131½	..	..	4 10 3
3,042	United River Plate Telephone	5	8 %	8 %	8 %	..	7⅞ — 7 15/16	7⅞ — 7 15/16	7⅞	..	..	5 7 9
120,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 8 11
40,000	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	2½%	2½%	2½%	..	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	3 16 4
30,008	Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4 %	4 %	4 %	4 %	98 —100	98 —100	..	..	..	4 0 0
150,000	Western Telegraph, Ltd., Nos. 1 to 307,980.. ..	10	7 %	7 %	7 %	..	13⅜ — 14½	13⅜ — 14½	13⅞	13⅜	..	4 18 8
307,980	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
800,000	West India and Panama Telegraph	10	Nil	Nil	Nil	..	⅛ — ⅜	⅛ — ⅜	18/6	..	..	Nil
88,831	Do. do. 6 % Cum. 1st Pref.	10	8 %	6 %	6 %	..	8½ — 9½	8½ — 9½	9⅛	..	..	6 9 9
84,668	Do. do. 6 % Cum. 2nd Pref.	10	Nil	£2 6	15 %	..	8¼ — 9¼	8¼ — 9¼	8 17/32	..	..	6 6 4
4,669	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	100½—102½	100½—102½	101	..	..	4 17 7
80,000‡												

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	5 %	4½— 4⅝	4½ — 4⅝	98/9	90/-	..	5 5 5
500,000	Do. 5 % 2nd Pref., 500,001 to 1,000,000	5	..	..	..	5 %	4⅜— 4⅝	4⅜— 4⅝	88/9	85/-	..	5 14 3
4,465,674	Do. 4 % Deb. Stock	Stock	..	..	4 %	4 %	90 — 91½	90 — 91½	91	90⅝	..	4 7 5
382,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	104 —106	104 —106	..	..	..	4 14 4
380,000	Babcock & Wilcox, 1 to 380,000	1	20 %	20 %	20 %	..	5⅜ — 5⅝	5 3/16— 5 5/16	5 5/16	5 1/16	..	3 16 2
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 1/16— 1 1/8	1 1/16— 1 1/8	..	..	..	3 19 2
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	Nil	..	⅜ — ½	⅜ — ½	..	..	..	Nil
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	3½ %	..	1 — 1⅛	1 — 1⅛	..	..	..	..
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	..	2⅛ — 2⅜	2⅛ — 2⅜	..	..	..	..
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	2 %	..	⅜ — ½	⅜ — ½	..	..	..	..
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	5½%	5½%	5½%	5½%	95 — 98	95 — 98	..	..	..	..
600,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	8 %	8 %	8 %	140 —144	143 —147	143½	142	+3	5 8 10
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	6 %	6 %	118 —122	119 —123	121	120	+1	4 17 7
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	110¼—112½	110¼—112½	..	..	..	4 8 11
283,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,900	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
188,801	British Electric Traction	10	Nil	Nil	Nil	..	1 — 1⅛	1 — 1⅛	23/1½	22/6	..	Nil
161,487	Do. do. 6 % Cum. Pref.	10	6 %	8 %	1½ %	..	2⅜ — 3⅛	2⅜ — 3⅛	66/3	57/9	+ ½	4 8 11
1,473,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	..	90 — 93	90 — 93	90½	89½	..	5 7 6
528,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	..	68 — 73	68 — 73	..	..	..	6 6 8
100,000	British Insulated and Helsby Cables	5	10 %	10 %	10 %	10 %	7⅜ — 7⅝	7⅜ — 7⅝	7 11/16	..	..	6 7 0
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅜ — 6⅝	6⅜ — 6⅝	6⅝	..	..	4 10 7
500,000	Do. do. 4½ % 1st Mort. Deb. Red.. ..	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
804,940‡	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	87 — 92	87 — 92	..	..	..	4 17 10
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 75,000	5	Nil	Nil	Nil	..	7/16— ½	½— 9/16	10/-	..	— 1/16	Nil
1,816,868	Do. do. 4 % Mort. Deb. Stock	100	4 %	4 %	4 %	..	47 — 51	47 — 51	..	..	..	7 16 10
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	13/16— 15/16	13/16— 15/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	Nil	Nil	Nil	..	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	Nil	Nil	Nil	..	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	39 — 44	39 — 44	..	..	..	10 4 6
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	25 — 29	25 — 29	..	..	..	15 3 0
137,610	Calcutta Trams, 1 to 137,610	5	8 %	6 %	4½%	..	4 — 4½	4 — 4½	85/-	82/6	..	5 0 0
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4½ — 5	4½ — 5	..	..	..	5 0 0
950,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	..	10¼— 11	10¼— 11	10⅜	10 1/16	..	6 0 0
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅛— 5½	5⅛— 5½	..	..	..	4 10 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	102½—104½	102½—104½	102⅝	..	..	4 6 2
491,223	Cape E. Trams., 1 to 491,223	1	Nil	Nil	Nil	..	2/16— ⅜	2/16— ⅜	7/6	7/-	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	8 %	12 %	12½%	..	2⅜ — 2½	2⅜ — 2½	48/9	48/6	..	5 0 0
210,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4 %	4½%	104 —107	104 —107	..	..	..	4 4 1
1,890 690	Central London Railway, Ord. Stock	Stock	4 %	8 %	8½ %	8 %	£8 — 70	70 — 72	71½	70	+2	4 8 4
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	£5 — 87	86½	..	..	4 13 0
554,655	Do. do. Def. do.	Stock	4 %	2 %	2½%	2 %	51 — 53	54 — 54	53½	52½	+1	3 14 1
1,480,000	City and South London Railway	Stock	3½%	3½%	1¼%	1¾%	30 — 31	30½— 31½	31	..	+ ½	5 10 8
85,000	Crompton & Co., Nos. 1 to 85,000	8	5 %	5 %	Nil	..	⅜ — ½	⅜ — ½	..	..	..	Nil
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 900 of £100, and 901 11,006 of £50 Red	..	5 %	5 %	5 %	5 %	88 — 91	88 — 91	..	..	..	5 9 11

* Unless otherwise stated, all shares are fully paid. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations March 8th.	Closing Quotations March 15th.	Business done week ended Mar. 15th, 1910.		Rise + or Fall —	Present Yield per cent.
		*	1906.	1907.	1908.	1909			Highest	Lowest.		£ s. d.
£80,000	Dick, Kerr & Co., 1 to 260,000	1	1) %	10 %	6 %	..	⅞ — 1	⅞ — 1	..	..	..	6 0 0
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000 ..	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/8	1 1/16 — 1 1/8	..	..	..	5 9 1
271,080	Do. do. 4½ % Deb. Stock	100	4½ %	4½ %	4½ %	4½ %	99 —102	99 —102	..	..	..	4 8 3
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	13 — 14	13 — 14	..	..	..	4 7 3
99,261	Edison & Swan Utd., "A" shs., £8 pd., 1 to 99,261	5	4½ %	2½ %	Nil	..	3/16 — 3/32	3/16 — 3/32	..	..	— 1/32	Nil
17,189	Do. "A" shares, 01—017,189 ..	5	4½ %	2½ %	Nil	..	1 — 1½	1 — 1½	..	..	..	Nil
807,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	65 — 70	65 — 70	65½	..	..	5 14 4
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	81 — 84	81 — 84	..	..	..	5 19 1
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	..	⅛ — ¼	⅛ — ¼	..	..	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890..	2	7 %	7 %	7 %	7 %	1½ — 1⅝	1½ — 1⅝	..	..	..	10 4 0
25,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	..	7½ — 8½	7½ — 8½	..	..	..	6 1 3
200,000	Do. do 4 % Mort Deb.. ..	Stock	4 %	4 %	4 %	4 %	83 — 87	83 — 87	..	..	..	4 12 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	½%	Nil	..	⅜ — ½	⅜ — ½	..	..	..	Nil
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	..	..	10½ — 10⅝	10½ — 10⅝	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	..	102 —103½	102 —103½	..	..	..	4 7 1
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15 %	15 %	15 %	13⅛ — 13⅞	13⅛ — 13⅞	13½	13¼	..	5 12 2
40,000	Do. do. 4½ % Pref.	5	4½ %	4½ %	4½ %	4½ %	5 1/16 — 5 3/16	5 — 5⅛ xd	..	..	..	4 3 9
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½ %	4½ %	4½ %	4½ %	105½ —107½	105½ —107½	..	..	..	4 3 9
50,000	India-Rubber, Gutta-percha & Telegraph Works..	10	10 %	10 %	10 %	10 %	15½ — 16	15½ — 16	16	..	..	6 5 0
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	½%	Nil	Nil	1 1/16 — 1 1/8	1 1/16 — 1 1/8	..	..	..	Nil
10,000	† Do. do. Pref., fully paid ..	10	5 %	5 %	5 %	5 %	4⅜ — 5½	4⅜ — 5½	..	..	..	9 10 6
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	3 %	Nil	..	1½ — 2⅛	1½ — 2⅛	..	..	..	Nil
999,980	Do. do. 60,008 to 100,000	10	3 %	3 %	Nil	..	1½ — 2⅛	1½ — 2⅛	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	3⅜%	..	2⅜ — 2⅝	2⅜ — 2⅝	48/1½	..	+ ½	13 0 10
1,649,980	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	70 — 73	70 — 73	72	..	..	5 9 7
5,732,062	Metropolitan Consolidated	100	1 %	½%	½%	1 %	41½ — 42	43⅛ — 44½	44¼	41⅜	+2½	2 5 2
2,640,914	Do. Surplus Lands	100	2½%	2½%	2½%	2½%	68 — 70	68 — 70	69½	68¼	..	3 18 7
5,295,000	Do. District	100	Nil	Nil	Nil	Nil	18½ — 18⅝	19 — 19½	19⅞	19 7/16	+ ⅜	Nil
891,327	Metropolitan Electric Trams., Ord.	1	..	..	½%	..	1/16 — 1/8	1/16 — 1/8	..	..	..	6 10 11
314,016	Do. do. Defd...	1	Nil	Nil	Nil	..	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
600,000	Do. do. 5 % Cum. Pref. ..	1	5 %	5 %	5 %	5 %	⅜ — ½	⅜ — ½	14/6	..	— 1/16	6 3 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	97½	97	..	4 10 11
$10,332,300	Mexico Trams Co., Common Stock	..	..	..	..	..	132 —134	133 —135	134⅜	133	+1	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	5 %	..	97⅛ — 99⅛	98⅜ — 99⅜	99	..	+ ⅜	5 0 3
245,500	Potteries Electric Traction	1	4 %	4 %	Nil	..	⅛ — ¼	⅛ — ¼	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	⅛ — ¼	⅛ — ¼	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	84 — 87	84 — 87	..	..	..	5 3 6
97,350	Telegraph Construction and Maintenance	13	15 %	17½%	15 %	17½%	85½ — 87	85½ — 87	86⅜	85½	..	5 12 11
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
1,000,000	Underground Electric Railway, 5% Prior Lien ..	..	..	..	5 %	..	101½ —102½	102 —103	102	..	+ ⅜	4 17 1
2,800,000	Do. do. 4½% Bonds	..	..	..	4½%	4½%	89 — 91	89 — 91	89¾	89¼	..	4 18 4
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	84 — 86	84 — 86	..	..	..	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	1	Nil	10 %†	5 %	..	⅛ — ¼	⅛ — ¼	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	6 %	6 %	6 %	6 %	1⅝ — 2½	1⅝ — 2½	..	..	..	2 8 4
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	68 — 73	68 — 73	..	..	..	5 9 7

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000	5	5½%	5½%	5½%	..	4¼ — 4⅜	4¼ — 4⅜	..	..	..	5 15 9
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	4½%	91 — 94	91 — 94	..	..	..	4 18 9
30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10%	10 %	10 %	10 %	7⅞ — 8¼	7⅞ — 8¼	..	..	..	6 1 3
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7¼ — 7⅜	7¼ — 7⅜	..	..	..	4 4 10
400,000	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply ..	5	5 %	5 %	5 %	5 %	4 — 4⅛	4 — 4⅛	90/-	85/-	..	5 11 1
80,000	Do. do. do. 4⅛ % Cum. Pref.	5	4⅛%	4⅛%	4⅛%	4⅛%	4 — 4⅛	4 — 4⅛	82/6	..	..	5 0 0
80,000	Do. "City Undertaking" 4½ % Cum. Pri.	5	4½%	4½%	4½%	4½%	3⅞ — 4⅛	3⅞ — 4⅛	..	..	..	5 2 10
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96½ — 98½	96⅜ — 98⅜	..	..	..	4 1 3
49,486	Chelsea Electricity Supply, Ord.	5	4½%	4½%	4½%	4½%	3⅝ — 4⅛	3⅝ — 4⅛	77/4½	..	..	5 9 1
175,000	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 8
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	7 %	12⅜ — 12⅝	12 — 12⅛	12 7/16	12½	— ⅛	5 12 0
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12½ — 13½	12½ — 13½	..	..	..	4 10 7
400,000	Do. 5 % Db. Stk.	Stock	5 %	5 %	5 %	5 %	121 —125	121 —125	..	..	..	4 0 0
800,000	Do. 4½ % 2nd. Db. Stk.	100	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
50,000	County of Durham Electrical Power, Ord.	5	4 %	2 %	Nil	Nil	1⅝ — 2	1⅝ — 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	2⅜ — 3⅜	2⅜ — 3⅜	..	..	..	7 8 2
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	5 %	5 %	91 — 98	94 — 96	..	..	+3	5 4 2
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅜ — 8⅛	7⅝ — 8⅜	8⅛	8	+ ⅛	5 19 5
65,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅜ — 11⅛	10⅜ — 11⅛	..	..	..	5 6 8
400,000	Do. do. 4½ % Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	108 —106	108 —106	105¼	104	..	4 4 11
400,000	Do. do. 4½ % 2nd. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	99 —102	100 —103	101⅛	..	+1	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	Nil	Nil	Nil	..	3/16 — 5/16	3/16 — 5/16	6/8	5/-	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	3 %	Nil	Nil	..	1 — 1½	1¼ — 1⅜	28/9	26/-	+ ¼	Nil
480,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	..	..	70 — 73	71 — 74	..	..	+1	6 1 7
$8,150,000	Electrical Dev.Co.of Ontario, 6% 1stMtg.Gold Bnds.	$500	..	..	5 %	5 %	80 — 83	80 — 83	..	..	..	6 0 6
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	..	4⅜ — 4⅞	4⅜ — 4⅞	..	..	..	6 12 10
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4⅞ — 5⅛	4⅞ — 5⅛	..	..	..	4 13 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
15,000	Hove, 1 to 15,000	5	9 %	8½%	8½%	8½%	7 — 7½	7 — 7½	..	..	..	5 13 4
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	..	5 %	5 %	102¼—104½	102¼—104½	103½	..	..	4 15 8
21,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	10 %	8 %	..	7½ — 7⅝	7½ — 7⅝	..	..	..	5 3 3
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	94½ — 96½	94½ — 96½	..	..	..	4 2 11
111,000	London Electric Supply Corporation, Limited, Ord.	8	4 %	2½%	3 %	..	1⅞ — 2⅛	1⅞ — 2⅛	..	..	..	4 4 3
70,000	Do. do. do. 6 % Pref. ..	5	6 %	6 %	6 %	..	4⅞ — 5⅛	5 — 5⅛	5⅛	5 1/16	+ ⅛	5 11 8
882,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4½%	4½%	4 %	4 %	92 — 94	92 — 94	92½	..	..	4 5 1
200,000	Metropolitan Electric Supply, 1 to 100,000	5	8 %	6½%	5 %	5 %	4⅛ — 4⅜	4⅛ — 4⅜	91/3	88/1½	..	5 5 3
70,191	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝ — 5	4⅝ — 5	..	..	..	4 10 0
225,000	Do. 4½ % 1st Mort. Deben. Stock ..	Stock	4½%	4½%	4½%	4½%	104 —107	104 —107	..	..	..	4 4 1
248,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83 — 86	83 — 86	..	..	..	4 1 5
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	..	88¼ — 85¼	84½ — 85½	85⅜	84½	+ ⅛	5 17 0
£3,585,000	Do. Light and Power Co., Ltd., Common ..	$100	..	..	3½%	..	80 — 82	82½ — 84½	83⅜	82	+2⅛	4 2 10
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	7 %	7 %	104 —106	104 —106	105	103⅜	..	6 12 1
12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	100	..	..	5 %	5 %	90⅜ — 91⅜	90⅛ — 91½	91½	90½	..	5 9 0
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	96 — 98	96⅛ — 98⅛	..	..	+ ⅛	4 11 5
180,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	2½%	..	4 — 4⅜	4¼ — 4⅜	..	..	+ ⅛	2 18 9
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4⅜ — 5	4⅜ — 5	..	..	..	5 11 1
125,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,255	100	..	..	..	5 %	99 — 101	99 —101	..	..	..	4 19 0
10,859	Notting Hill Electric Lighting..	10	7½%	7½%	7 %	..	12½ — 13½	12½ — 13½	..	..	..	5 1 10
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	..	7 %	6⅝ — 6⅞	6⅝ — 6⅞	..	..	..	3 16 9
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 0 0
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507 ..	1	2½%	6 %	8 %	..	1⅝ — 1⅞	1⅝ — 2	38/9	..	+ ⅛	6 1 11
100,000	Do. do. 6% Non Cum. Pref. Nos.1 to 100,000	1	6 %	6 %	6 %	6 %	1⅝ — 1 17/32	1⅝ — 1 17/32	..	..	..	5 19 0
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	102¾—104½	102¾—104½	103⅜	..	..	4 15 8
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	10 %	10 %	10 %	10 %	8⅝ — 8⅞	8¾ — 9	8⅞	..	+ ⅛	5 11 1
80,000	Do. do. 7 % Pref. 20,001 to 40,000	5	7 %	7 %	7 %	7 %	6⅞ — 7⅛	6⅞ — 7⅛	7⅛	7 1/16	+ ⅛	4 16 7
160,000	Do. do. 3½ % Deb. Stock Red. ..	100	3½%	3½%	3½%	3½%	83 — 87	83 — 87	..	..	..	4 0 6
12,000	Smithfield Markets Electric Supply, Ord.	5	Nil	Nil	Nil	..	1⅜ — 2⅛	1⅜ — 2⅛	..	..	..	Nil
85,000	South London Electric Supply, Ord.	4	3 %	4 %	5 %	5 %	2⅜ — 3⅛	2⅜ — 3⅛	..	..	..	9 6 1
100,100	Do. do. 5 % 1st Mort. Deb.	100	..	..	5 %	5 %	100 —103	100 —103	..	..	..	..
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	..	7/16 — 9/16	7/16 — 9/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1⅜ — 1⅝	1 1/16 — 1 1/8	..	..	— 1/32	5 17 11
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	⅞ — 1	⅞ — 1	..	..	+ ⅛	25 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	1⅝ — 2	1⅝ — 2⅛	..	..	+ ⅛	10 10 6
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	76 — 78	78 — 82	..	..	+3	5 9 9
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 808,000 ..	1	..	..	5 %	..	27/32 — 29/32	27/32 — 29/32	..	..	..	5 6 8
100,00	Westminster Electric Supply, Ord.	5	12 %	10 %	10 %	10 %	8⅞ — 9	8⅞ — 9	8⅞	8 7/16	..	5 11 1
51,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	4½%	4½%	4½%	4½%	4½ — 5⅛	4½ — 5⅛	5⅛	..	..	4 3 9

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 3 per cent., February 10th, 1910.

INCOME-TAX IN RELATION TO THE ELECTRICAL INDUSTRY.

By GEO. JOHNSON.

It would be an injustice to deny to the subject of income-tax the distinct species of regard which we usually legitimately entertain for that specimen of human enigma commonly and appropriately revealed to us as our so-called friend or arch enemy. Like him, not only is it endowed with a depth of somewhat unfathomable subtlety of the double-face variety, but it is also prolific of anomalies. Income-tax is said to be a tax upon what is deemed to be income or profit for the purpose of the impost within the meaning of the Income-Tax Acts, the vagueness of which is commensurate with its brevity. Alluding generally to some of the more important features of income and expenditure on revenue account, it may be observed, incidentally, that the Board of Inland Revenue has given effect to a proposal of general application to electric tramways which has for its object the making or granting of a systematic allowance for depreciation of the permanent way based upon its life, which in turn is estimated upon a scale of car-mileage. Briefly, it is that if the car-miles do not exceed 50,000 per mile of track per annum the life is to be accepted as 16 years. If in excess of that number, but not more than 75,000, 14 years; if over 75,000, but not in excess of 125,000, 12 years, and if any instances occur in which the number exceeds 125,000 car-miles per mile of track per annum they are to receive special consideration. And here, it may be interposed, may arise, in computing the allowance, some simple arithmetical problems. In the process of calculating the assessable profits for income-tax purposes, no deduction is to be permitted for repairs and maintenance of the permanent way; but in order that any item of that nature may not be left in the position of being unable to defend or justify its inclusion, the depreciation allowance is to be arrived at in such a manner that it will be equivalent to the combined cost of renewal and repairs and maintenance; moreover, it is decided that recourse will be had to a certain process of computation which we shall observe presently. It is satisfactory to note that the definite distinction between repairs and maintenance and renewals, or between the former and depreciation, or wear and tear as it is frequently termed, have not proved to be beyond comprehension or discriminating intelligence. The cost of renewals, including setts or other paving, but excluding concrete foundations, is to be taken at £4,400 per mile of single track until the general renewal of the track takes place. The amount to be added in respect of ordinary repairs and maintenance to renewals is to be ascertained by taking the actual average of such expenditure as shown by the accounts of the undertaking for the past three years, or such period less than three years, that the undertaking has been in existence or operation. The process of computing the allowance for depreciation, assuming, by way of example, that the actual average expenditure upon the repairs and maintenance of the permanent way as ascertained according to the mode described, is, say, £100 per mile of track per annum, may be shown as follows :—

Cost of renewal per mile of single track	£4,400
Add average cost of repairs and maintenance at, say, £100 per mile of single track in respect of an undertaking possessing a track with an unexhausted life of, say, 16 years	1,600
	£6,000

and $\frac{6000}{16}$ = £375 per annum per mile of track to be allowed.

If we assume, for the sake of illustration, a single track of 16 miles, and a life of 16 years, as well as an estimated sum of £100 as the cost per mile of such track, we have—

4,400 × 16 = £70,400 cost of renewal
100 × 16 × 16 = 25,600 cost of repairs and maintenance.

£96,000 total cost
£375 × 16 × 16 = £96,000 total allowance.

The term repairs is to include the renewals of special track work at junctions and cross-over roads, which occur at frequent intervals, whilst the allowance of £4,400 for renewal of the permanent way is to apply to the overhead trolley system only. Special arrangements are to be made in respect of conduit, surface-contact, and other systems of electric traction. Provision is made for the consideration of cases entitled to be designated special, due, probably, *inter alia*, to exceptional gradients, the compulsory use of wood paving and other causes in which the car-mileage method of solution may not represent fairly the wear and tear of the permanent way.

Attention may be drawn to the obvious fact that, as expenditure on repairs and maintenance is likely to increase with the age of the track, the yearly sum ascertained in the manner described for repairs and maintenance may be found in course of time to be inequitable or unsatisfactory, in which event the figures which have been taken as the current basis may be submitted for revision at the expiration of every five years, when the allowance may be increased or diminished, as circumstances determine, in accordance with the general example which we have given above.

No expenditure upon extensions and improvements will be allowed as a deduction from the earnings for the purpose of income-tax; but an allowance for depreciation upon the lines indicated will be made in respect thereof. There are, however, but few instances in which extensions of any moment have been charged to revenue. It is enjoined that a careful account of all such annual allowances of the actual expenditure on repairs and renewals should be kept, so that, at the end of the first or other period of revision (*i.e.*, every five years), or when the general renewal of the permanent way shall have become an accomplished fact, the future amount to be allowed shall be considered and increased or diminished according to the experience derived from a review of each particular case.

An allowance for depreciation at the rate of 3 per cent. per annum on the written-down amount of the cables cannot by any stretch of the imagination be characterised as erring on the side of liberality. But there it is; you may take it or leave it. Assent to the deduction of repairs, however, is on record. Written down value is interpreted as original prime cost, plus subsequent additions, less all allowances actually granted by the authority in respect of wear and tear. Here, again, difference of opinion is far from being inconceivable. To some undertakings the language of prime cost is somewhat precious.

Depreciation in respect of overhead equipment—that is, trolley wires and connections—is disallowed; but all expenditure upon maintenance and renewals may be charged as and when incurred against revenue for the purposes of income-tax.

Maintenance and renewals of cars and other rolling stock will be accepted and allowed as working expenses, instead of the granting of an allowance for depreciation. When, however, the circumstances are sufficient to justify a depreciation allowance, a rate of 7 per cent. per annum on the written down amount may be granted provided that a proper account is kept of all renewals, and that if the renewals are charged to the revenue account (as they should be), they are either shown therein separately or properly disclosed to the surveyor, in order that they may be added back, to use an income-tax procedure phrase, in arriving at the assessable profits. If a depreciation allowance be agreed upon, the annual or other periodical expenditure on repairs is to be recognised in the ordinary course in the tortuous path of reaching the assessment liability.

Whilst on the subject of cars, allusion may be made to the case of the London County Council when it acquired certain horse tramways and converted them to electric traction. The facts would appear to be that the L.C.C. discarded some 322 horse cars, which had been purchased in 1899 for £160 each, and substituted therefor cars suitable for electric traction costing from £650 to £850 each. It was submitted that the then existing cost of similar horse cars would have been about £200 each. The L.C.C. claimed an allowance which could be represented as renewals in respect thereof; but the surveyor refused to entertain the claim, on the basis that the cars were not discarded because of wear and tear, but because they were unsuitable for the purpose of electric traction to which system they had converted the horse tramways, and his contention was upheld.

Similarly in regard to the permanent way, the L.C.C. converted certain horse tramways to electric traction, necessitating the use of a heavier section of rail. In 1904 some 38 miles of reconstructed permanent way were in operation. Previously it was customary, instead of allowing depreciation, to allow renewals as a deduction, and the custom was continued by the L.C.C. after it had acquired the horse tramways and in 1904. The L.C.C. claimed not for entire renewals, but for such a proportion as would have represented the cost of constructing or relaying the permanent way as before the introduction of electric traction. Of the 38 miles of permanent way, five were said to be incapable of further use, whilst an unexhausted life of 11 years and six years was assigned to 18 and 15 miles respectively. On an estimated 20 years' life, there was an unexhausted period of some 12 years, and it was estimated that the cost of renewing the permanent way as before would have been some £3,725 per mile, which apparently was less than the first cost. The Council submitted that it was entitled to claim $\frac{1}{2}\frac{2}{0}$ths, or $\frac{3}{5}$ths of £3,725 for 38 miles, or failing its admission, to £3,725 for five miles. The surveyor was willing to allow the latter.

General plant and machinery receive a meed of condescending uniform recognition. Represented by the comprehensive nomenclature of "all other plant and machinery," including standards, brackets and workshop tools, but excluding loose implements, office furniture and small articles requiring frequent renewal, the item is to be brought into the income-tax hotch-potch, and subjected to a depreciation allowance at the rate of 5 per cent. per annum upon the written-down amount, in accordance with the definition already indicated, whilst any expenditure incurred upon such plant and machinery receives acceptance in full. Renewals should not fail to embrace replacements due to obsolescence; and whether the periodical accounts disclose any liability for income-tax or otherwise, the depreciation and repair and renewal problems should be considered each year with the surveyor, and agreed.

In order to satisfy their requirements, local surveyors will no doubt require in future a clear disintegration of the composition of many agglomerate sections or descriptions of income and expenditure which it may be a current custom to exhibit in a single or a too concisely grouped fashion.

It may be interesting to observe that in future no allowance in any circumstances is to be allowed to gas and water undertakings for depreciation. In electric lighting undertakings, as in those of electric tramways, cables are to be subject to a depreciation allowance upon the written-down amount at the rate of 3 per cent. per annum, and repairs are permitted. For conduits no allowance for depreciation may be granted; but repairs and maintenance and renewals are recognised as working expenses against revenue, as and when incurred in the usual way. On plant and machinery, except loose tools, meters and office furniture, a depreciation allowance of 5 per cent. per annum upon the written-down sum is permissible, in addition to the cost of repairs. Repairs and renewals of meters, loose tools and office furniture are to be allowed, as such expenditure thereon is incurred as charges in the income-tax account.

By Sec. 25 of the Finance Act, 1907, no deduction can be made on account of any royalty or other sum paid in respect of the user of a patent, the taxpayer being entitled to deduct the tax before payment of the royalty.

From the latest interpretation of hire-purchase transactions from an income-tax point of view, it would appear that the entire payment is to be treated as capital—no portion of the periodical instalments being interest or "hire." It is a somewhat curious incidence, but if it be correct, it is in entire sympathy with the non-alignment of the subject of income-tax. In many hire-purchase agreements, however, no mention is made of interest, though interest is inseparable from a translation of the terms of their construction.

In determining the income-tax liability, law charges are generally allowed as a deduction; but all such expenditures arising from the flotation of a limited liability company, the issue of loans and shares, and other similar matters are disallowed. The precise nature of each item of charge must be considered.

Annual interest is not allowed as a deduction. It is a phrase somewhat vague; but it applies to interest on debentures, bonds and fixed loans. Income-tax should be deducted always from interest of that nature, inasmuch as we have just stated it is not allowed as a deduction in the process of arriving at the taxable profits. Interest "other than annual" consists amongst other items of interest on overdue accounts, interest or discount, as it is termed, on bills discounted, and the like, the deduction of which is acknowledged and authorised. Bank interest payable by an undertaking is allowed as a deduction, since according to general custom it is paid in full by the latter and appears in the pass-book. The surveyor in such instances may desire to be supplied with the name and address of the bank for reference thereto. Bank interest on deposits receivable by an undertaking must remain in the account, since it is credited to the undertaking in the pass-book by the bank without deduction.

Dividends received and receivable on investments, whether tax has been already deducted, or whether the dividends are "f.i.t.," should also be shown on the debit side of the income-tax account as well as on the credit side, since they already constitute taxed income.

PROCEEDINGS OF INSTITUTIONS.

The Ignition of Coal Dust by Electric Flashes.

By Prof. W. M. Thornton.

(*Demonstration before the* Institution of Electrical Engineers, *Newcastle, February 21st*, 1910.)

Dr. Thornton said that of all the great forces of Nature, electricity was the most easily controlled and the safest for use in mines, provided that due care were taken in the installation and maintenance of the necessary apparatus.

It might be said that the experiments he intended to show were open to criticism, in that they did not approximate to actual working conditions, but at least they would show what happened when an electric flash took place in the presence of coal dust, and it would then be possible to deduce how far the results could be applied to these conditions.

It had been found that a steady temperature of 140° C. was quite sufficient to ignite some dusts, but the present experiments would be with momentary flashes only, and such as would arise from a fuse blowing, a cable breaking, or a quick-break switch being opened under load.

The dust used had not been specially prepared, but had been taken off the timber in a colliery in the Durham area. It was, of course, very probable that specially fine dust would give different results, and a mixture of gas and dust would certainly be worse to deal with and guard against than simply a cloud of the latter.

It had been found by Mr. Wood that dry coal dust was a perfect insulator, and the resistance of a tube of dust about 3 in. long × $\frac{1}{4}$ in. diameter was so great that with 480 volts sufficient current could not be got through to give an indication on the most sensitive galvanometer in the Armstrong College. Also, contrary to the general belief, solid coal was a very much better insulator than stone.

Dr. Thornton then showed that a heap of dry coal dust between two terminals $\frac{3}{8}$ in. apart was not affected, and that no current passed, with 480 volts between the terminals. When it was moistened, however, steam was given off, and the heap was observed to glow, finally allowing current to pass sufficient to blow a 1-ampere fuse.

Inspected closely, the glowing effect was seen to be due to a fine stream of sparks passing between the terminals, and the lowering of the resistance was evidently due either to the carbonising of the particles of dust or to the formation of a conducting gas.

Dry coke dust, on the other hand, acted as a conductor, and the effect of putting some between the terminals was similar to that observed in the case of the wet coal dust, but the action was somewhat slower.

Dry stone dust showed no effect whatever when placed between the terminals, and when moistened it simply steamed until dry.

A curious effect shown was that wet coal dust was affected much more rapidly by alternating than by direct current.

It was then shown that a simple flame, such as that of a taper or match, could not start an arc across terminals with 480 volts between them, but when the voltage was in the neighbourhood of 1,500 an arc could be started by a flame, due to the combustion of hydrocarbons.

The flash due to a fuse blowing was, however, in an entirely different category, and by arranging two terminals with 480 volts between them immediately over a 100-volt fuse, it was found that an arc could be started between them by blowing the latter.

This suggested to Dr. Thornton that distribution fuse boxes, in which the opposite poles were separated by an insulating shield only, should always be arranged with the bus-bars at the bottom, as there was thus much less chance of an arc being started inside the box in the event of the fillet being broken and the box becoming partly filled with metallic vapour due to a fuse blowing.

Dr. Thornton then carried out a large number of experiments with the aid of an apparatus consisting of a box in which a fuse could be blown, and also fitted with a quick-break switch operated from the outside. Leading into the box was a short length of glass tubing, about 2½-in. diameter, to the outer end of which an arrangement was fitted by means of which coal dust could be blown

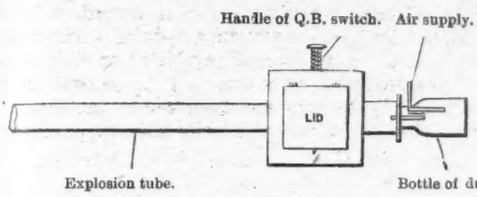


FIG. 1.—PLAN OF APPARATUS EMPLOYED.

into the box. From the other side of the box a similar but much longer glass tube projected. When the dust ignited in the box the resulting flame was seen to travel along the longer tube, and the violence of the explosion could be gauged from the length of the flame.

The following table is the result of a series of experiments with the above apparatus on a 480-volt non-inductive-circuit, using a quick-break switch:—

Current in amperes.	Resistance in circuit.	Number of trials.	Number of ignitions.	Per cent. of ignitions.
5·79	80	33	0	0
6·67	69	37	3	8·1
7·14	64	39	7	18
7·65	60	30	6	19·8
10·3	45	20	12	60
13	35	10	10	100
25	18·5	10	10	100 violent

Plotting per cent. of ignition against current the points are found to lie on a straight line, and this line cuts zero per cent. ignition at 5·79 amperes, i.e., per cent. ignition is proportional to current minus a constant; or, in other words, per cent. ignition is proportional to the volume of the flame less a constant.

Experiments on a 1,000-volt circuit gave similar results, except that the minimum current capable of producing an explosion was considerably smaller.

A similar series of experiments with alternating current showed that for similar conditions the percentage of explosions was reduced by half, which would tend to show that from the aspect of dust explosion alternating current is approximately twice as safe as direct current. For instance, the switch was operated repeatedly, breaking 13 amperes, in a cloud of coal dust, without a single ignition occurring. The following table gives a few results with alternating current:—

Volts.	Amperes.	P.F.	Trials.	Ignitions.	Per cent.
250	23	·75	32	3	10
470	10	·8	70	0	0
635	11	·78	30	4	13

When blowing fuses in a cloud of dust it was found that with low-pressure current, say, 480 volts, an excess of current over and above that required to blow the fuse had a considerable influence on the percentage of explosions, but with higher voltages no excess was necessary, as an explosion could be produced with certainty with the minimum current required to blow the fuse. Regarding the influence of the amount of power behind the flash, it was found that on a 100-volt circuit 5 KW. was the value below which an explosion could not be produced.

Very violent explosions can be got with ordinary flour, and cases are on record of flour mills being wrecked by internal explosions due to the ignition of flour dust in the air.

The greater explosiveness of flour is probably due to its fine state of sub-division, and also to the amount of easily oxidised material in its composition.

In the discussion which followed, MR. RUTHERFORD (Ferry Hill) said that Dr. Thornton's experiments showed the dangers which collieries had to contend with, and they naturally led to questions of protection, but up to the present none of the many systems on the market had been long enough in operation to show whether or not it was really perfectly safe.

MR. PROCTOR (Edison & Swan) said that the action of coke dust was probably due to the presence of tar, which was a conductor, and this same action had considerable bearing on the manufacture of incandescent carbon-filament lamps.

MR. CLOTHIER (A. Reyrolle & Co.) said that as Dr. Thornton was dealing with small arcs only it might be urged that he did not approximate working conditions, and this was undoubtedly true, but what was of more importance, they showed what the effects of even a small arc could be, and, of course, with larger arcs and larger volumes of dust the results would be proportionately magnified. A greater danger, however, was the presence of gas, and it was acknowledged that many coal-dust explosions were initiated by small gas explosions. He showed the members two boxes, one having the ordinary rubber gasket between the box and the lid and of the type usually called gastight, but the rubber ring was very liable to damage, and then the box became a source of danger. He then filled the box with a mixture of gas and air and exploded the contents by means of a small sparking coil and plug, and the tongue of flame which shot out of the joint opposite a small cut in the rubber was ample proof of the positive danger of this type of box. The other box was of considerably stouter build, and the joint between the body and the lid was simply a flat machined face about two inches wide. Exploding a charge of gas in this box produced no effect beyond a dull thud, and several members were able to hold their hands close up to the joint without feeling more than a puff of slightly warm air. Mr. Clothier explained that the effect was due to the cooling action of the large mass of metal surrounding the joint, which cooled the burnt gas to a temperature far below that at which it could ignite any gas which might be in the air immediately surrounding the box.

MR. HODGE (British Westinghouse Co.) said that the principle shown by Mr. Clothier was a step in the right direction, and his own firm had employed the same principle for some years, but they used a V joint instead of a flat one.

Possible Uses of Waste-Gas Power.

By I. V. ROBINSON, Wh.Sc.

(*Abstract of paper read before the* WEST OF SCOTLAND IRON AND STEEL INSTITUTE, *February*, 1910.)

THE surplus power from blast furnaces capable of producing 100 tons of pig-iron per day has been estimated by Mr. L. Greiner, Liége, as follows: Heating the blast, 45 per cent.; blowing engines, lifts, &c., 15-20 per cent.; available balance, 40-35 per cent.; equivalent surplus power, B.H.P. per 100 tons per 24 hours, 3,020.

This estimate is based on a heat consumption of 9,370 B.TH.U. per B.H.P.-hour, and this figure is very closely confirmed by a test carried out some time ago upon a 1,100-B.H.P. gas engine made by Messrs. Richardsons, Westgarth & Co., Ltd.

There are within a radius of 20 miles of Glasgow 62 furnaces, and the total production within the Glasgow District is about 20,300 tons per week, if all the furnaces are in blast; but, on an average, only 75 per cent. of the furnaces have been in blast, and the average output would, therefore, only be 15,225 tons per week, or 2,175 tons per day. The surplus power that would be available from these furnaces at a rating of 3,000 B.H.P. per 100 tons of pig-iron per day would be 65,250 B.H.P., or with an efficiency of 95 per cent., 62,000 E.H.P., an average of 1,000 E.H.P. per furnace.

The maximum demand for the last completed year of the various Corporation electricity supply departments in the Glasgow district amounted to slightly over 49,000 E.H.P.

The sizes of the gas power stations suitable for utilising the surplus power available in the Glasgow district would vary from 5,000 E.H.P. to 12,000 E.H.P., and the total capital cost of the power stations has been calculated as £747,450, an average per E.H.P. installed of about £12 1s. This figure is on the high side, and can be reduced at least to £10 per E.H.P. installed.

The works costs may be divided into repairs and maintenance; oil, waste and stores; and labour.

Various data have been published regarding the running costs of gas engines. Some of the engines were supplying power to machine shops working about 54 hours per week, and the load factor was only about 20-25 per cent. Other engines were supplying power to combined iron and steel works, &c.; these engines may be running practically full time (8,760 hours per year), but as they are not always fully loaded, the load factor is only from 50·65 per cent. Again, some gas engines were running fully loaded for practically full time, driving blast-furnace blowing cylinders, with a load factor of 95 per cent. In order to compare all these cases, the total costs of repairs, maintenance and stores require to be corrected to a common load factor of 100 per cent.

Mr. Leon Greiner states that his total costs when working under a load factor of 50 per cent. amounted to ·0465d. per E.H.P. per hour. He estimates that the cost with a 100 per cent. load factor would be ·0233d. per hour, of which cleaning and repairs would amount to 35 per cent. This is equivalent to 6s. per E.H.P. per year. The average cost of repairs per E.H.P. per year of various installations cited is 3s. 4d.

The average cost of oil, waste and stores, &c, in three actual cases is 3s. 3d. per E.H.P. per year.

The cost of labour will probably vary from 4s. to 8s. per E.H.P.-year in large and small stations, or a mean of 6s.

It would thus apparently be safe to assume that the total works charges on a large gas-engine installation would not exceed 12s. 7d. per E.H.P.-year. But to allow a margin to cover contingencies and management expenses, the cost will be taken as 15s. Providing for 5 per cent. interest and 7½ per cent. depreciation, the total cost per E.H.P. per year will be £2 5s.

Blast-furnace owners have available a large amount of power for which they have not, up to the present, found any useful purpose, and in their immediate neighbourhood there are large corporations or power companies which have equipped power stations to supply power within their boundaries. There is no reason why blast furnaces should not eventually supply practically all the power that is required in the neighbourhood, and the co-operation of the blast-furnace owners and the power supply departments and companies would be a mutual advantage.

It is shown in the appendix that the average modern power

station using coal-fired boilers cannot generate an E.H.P.-year for less than, say, £4 16s. 6d., and in the Glasgow district for less than £6 2s. 6d.

In a gas-engine station using blast-furnace gas, an E.H.P. can be generated for a complete year at a total cost of about £2 5s. To this has to be added the profit, which will be assumed to be 10 per cent. of the capital cost of the plant, or 24s. per E.H.P.-year. This item may be regarded as the cash value of the gas used, and is equivalent to ·044d. per unit generated, assuming a 100 per cent. load factor. Allowing for 5 per cent. of the power being used in the power station, the sale price at the power station will be £3 12s. 9d. per E.H.P.-year.

The power generated at the various works could be collected at a central transmission station, from which overhead transmission lines would convey the power to the boundary of the purchasing corporation's area. If a local power company purchased the power, it would be in a splendid position to attract 100 per cent. load factor consumers, who would then be induced to start special works in the immediate vicinity of the central collection and transmission station.

Assuming that a special company were formed, the capital required would be about £160,000, as the total cost of the transmission lines, transformers, &c., would be about £140,000. This allows for generation and transmission at 10,000 volts and step-down transformers at the consumers' boundary. Allowing 5 per cent. interest and 5 per cent. depreciation, the annual capital charges will be £15,000. The transmission lines could be kept in order for about £3,000 per year, and an allowance of £1,000 per year for wayleaves, &c., makes the total transmission costs £19,000 per annum. The aggregate output of the various stations is 62,000 E.H.P. × ·95, or 58,900 E.H.P. The transmission charges are thus about 6s. 5d. per E.H.P.-year, and allowing for 7 per cent. loss in transmission, &c., the total sale price at the Corporation's boundary would be about £4 5s. per E.H.P.-year.

The Glasgow Corporation electricity department in the year ending May, 1909, had a maximum demand of 21,585 KW., or about 29,000 H.P., and their total works charges amounted to £69,000. This is equivalent to a works cost of £2 7s. 6d. per H.P. of maximum demand. In the tramways department the maximum demand was 12,150 H.P., and the total works charges were £37,850. In this case the works costs were £3 2s. 4d. per H.P. of maximum demand. The above figures are based upon load factors of 18·35 per cent. and 37·5 per cent., whereas the estimate for the blast-furnace power station is based upon a load factor of 100 per cent. Under existing conditions it would probably pay the Corporation to take, say, one-half of their maximum demand from the blast-furnace gas-power stations and generate one-half from their own coal-fired stations, the exact proportion depending entirely upon the average daily load curve.

One of the largest examples of co-operation is in Westphalia. In this district a large number of the owners of blast-furnaces, coke ovens, &c., have put down plant and are selling their surplus power to the Rhenish Westphalian Electricity Supply Co. This company has a large power station at Essen equipped with 5,000 KW. turbos, and is taking many millions of units per annum from the various blast-furnace owners and mining companies in that district. Some of the mines are selling surplus power to the Rhenish Westphalian Co., which they generate from the exhaust steam of their winding engines in low-pressure turbos. A similar scheme has been started on the north-east coast of England, where a subsidiary and non-statutory company, named the Waste Heat Power Co., has purchased the gas from the furnace owners, equipped power stations to use this gas, and sold the power to the various power companies which are working together in Northumberland, Durham and Yorkshire.

With reference to the reliability of the gas engine, it may be stated that two 1,100-B.H.P. gas engines which were supplied to the Coltness Iron Co. by Messrs. Richardsons, Westgarth & Co., Ltd., have, during the past year, run 15,043 hours of the total possible 15,698 hours. The Coltness Iron Co., Ltd., are the first firm in the United Kingdom to install plant to make cement from slag, a process which provides a profitable outlet for slag and power, both waste products of ironworks.

The manufacture of nitrogenous compounds has been taken up so rapidly on the Continent that they are now the chief product of the electrochemical industry. Nearly 100,000 H.P. is used exclusively for this manufacture. The operating expenses with gas and water power will not differ very greatly. In the author's opinion it is quite possible for many processes which, up to the present, have only been worked by water power, to be adopted in this district, where cheap power can be obtained by the proper utilisation of the waste gases.

Messrs. Birkeland and Eyde and Messrs. Pauling produce about 900 lb. of anhydrous nitric acid per E.H.P.-year, this corresponding to about ½-ton of manure. The output of cyanamide per E.H.P.-year appears to be about 1 ton, but no definite figures are obtainable. There does not seem to be any reason why the cyanamide process should not be carried on in this country with success. The raw material required, calcium carbide, is already being made in this country with power supplied from a coal-fired steam-turbo station.

Many chemicals are being manufactured in Great Britain in electric furnaces supplied with power from producer-gas power stations and from coal-fired steam-turbo stations. From neither type of power station can power be obtained at such a low rate as from the waste-gas station.

Where iron and steel works are adjoining, considerable fuel economy could be obtained by arranging for all mills to be driven by motors.

Electric steel furnaces could be adopted with profit. The output of steel per E.H.P.-year varies from 8·9 tons (cold scrap) to 17·7 tons (hot scrap).

The majority of the furnaces in use make special steels, such as tool or projectile steel, but a number produce steel used for general steel castings.

Appendix.

The works costs for the Glasgow Corporation Electricity Department power stations for the year ending May 31st, 1909, were:—Fuel, ·25d. per unit; oil, ·02d.; wages, ·10d.; repairs, 05d.—total, ·42d. per unit. The total output was 32,736,058 units, and the average load factor of the station was 18·35 per cent. Correcting the various items for the difference between load factors of 100 per cent. and 18·35 per cent., it has been assumed that the fuel used per unit will be reduced in the ratio of 1·298 to 1·00; the cost of repairs and of oil will probably be three times as much as for the 18·35 per cent. load factor, and the total cost of wages per annum will be increased by 20 per cent. The total cost per unit sold will then be ·2530d., equivalent to a total cost of £6 17s. 6d. per E.H.P. per year.

At the Glasgow Corporation tramways department power station the total works cost is ·35d. per unit; the output is 25,944,010 units, and the load factor 37·5 per cent. Dealing with the various items, as before, the wages are increased 10 per cent., the oil 47 per cent., the repairs 47 per cent., and the fuel has been decreased in the ratio of 1·184 to 1·00. With these corrections, the total cost works out at ·2257d. per unit, or £6 4s. per E.H.P.-year.

By taking the lowest recorded cost for each item in any British power station, and correcting the amount for a 100 per cent. load factor, the following figures are obtained:—

Fuel, ·1346d.; oil, ·0055d.; wages, ·0102d.; repairs, ·0275d. Total, ·1778d. per unit. This amounts to £4 16s. 9d. per E.H.P. per year.

This figure is, then, the lowest cost at which power could be generated in the average modern power station, while with blast furnace gas power stations the cost per E.H.P.-year would be £2 5s.

Discussion.

Mr. W. W. Lackie said that this was the second paper Mr. I. V. Robinson had read in Glasgow advocating the use of large gas engines for the driving of generators for the supply of electrical energy. He entirely disagreed with this and the general conclusions arrived at. Mr. Robinson's scheme briefly was that there should be nine separate stations with nine staffs of men for the generation of electrical energy, which would be collected at one centre and then distributed to consumers in and around Glasgow. He thought that bringing the costs to a common load factor of 100 per cent. led to several erroneous conclusions. Practically all the other figures given in the paper, and the figures that were available, were for charges with load factors running between 18 and 40 per cent., and it would be much more interesting if Mr. Robinson reduced his figures for gas-engine plant to a load factor of 20 or 40 per cent., which was the load factor that would be got in his general supply scheme. Mr. Robinson's method of finding out the actual cost of repairs and oil and labour was by no means satisfactory. There was a great diversity in the cost of each of these items according to whether the load factor was obtained by running plant for 54 hours a week only, or obtaining the same load factor, but running the plant for 24 hours a day and seven days a week. Dealing briefly with the cost of repairs and maintenance, in Mr. Lackie's opinion this was largely a question of labour. The cost of repairs and maintenance in Glasgow last year was 3s. 4d. per E.H.P. per annum. This was made up of 2s. 5d. for wages and 11d. for material. It would, therefore, appear that repairs and maintenance were almost standing charges, and the repairs consisted of an annual overhaul of the plant, and did not vary with the horse-power or the number of units generated. In the paper the cost of repairs on the gas engines at Seraing was given as 6s. 3d. per E.H.P. per annum, and the explanation given was that this plant was eight years old. Were they to take it that the cost of repairs on gas engines doubled in eight years? The cost of lubrication was given as 3s. 3d. per E.H.P. The corresponding figure in the electricity department last year was 1s. 10d. He had been unable to grasp how Mr. Robinson made the cost of oil in the electricity department stations ·0079d. per unit, and the cost in his proposed gas station ·0053d., while he stated elsewhere in the paper that the cost of lubrication in the gas station was 3s. 4d. per E.H.P., against which he had already put the electricity department's figure of 1s. 10d. The cost of labour was also one depending upon whether the supply was available for 24 hours a day or whether the labour was confined to engines which were run for only 54 hours a week. In the former case, wages would be three times as much as in the latter case. The most contradictory part of the whole paper was where it was stated that the total cost per E.H.P. from the gas-engine station would be £4 5s., and it was admitted that the total cost per E.H.P. from the Glasgow Corporation Electricity Department during the last year was £2 7s. 6d. The maximum demand on the electricity department's stations was given last year as 29,000 H.P., and the total works charges were stated as £69,000. He did not know where Mr. Robinson got the figure of £69,000. The cost of generation was £59,332, but this included the whole of the wages of the generating stations and sub-stations. It also included £1,200 for repairs of buildings and £451 for repairs of accumulators. This would really bring down the cost per E.H.P. to less than £2

per annum. Mr. Robinson admitted that it would not pay the Glasgow Corporation to purchase the whole of its energy from blast-furnace owners at the rate of £4 5s. per E.H.P., but he contended that under existing conditions it would probably pay the Corporation to take, say, one-half of its maximum demand from the blast-furnace power stations, and generate one-half from its own coal-fired stations. Let them consider what this meant. The total H.P. just now was 29,000. Assume for the moment that they took 14,500 H.P. at £4 5s.; this would cost £61,625, or more than their total works cost for the whole 29,000 H.P. It would really mean that they would require to supply the balance of 14,500 H.P. for less than nothing, if they were to maintain their present charges to consumers. He could not see that it would pay to purchase any portion of their demand at £4 5s. per E.H.P. It was a pity Mr. Robinson did not use the figures available for actual gas-driven electricity stations using, say, suction gas and eliminating the cost of fuel. On one station where there was practically 2,000 KW. of plant, the cost of repairs worked out at 39s. per H.P. per annum; the cost of wages was 18s. 9d.; and the cost of oil, 5s. 10d. Practically similar figures were yielded by two other small stations. In the published figures for a very large gas engine plant used for electricity supply the makers' guarantee was 0·305d.; the actual figure obtained was 1·191d. per unit. In his opinion to depend upon a by-product of some other industry (which might shut down at any time) for the supply of electrical energy to Glasgow and the surrounding district was absolutely wrong. It was not proved that it would be cheaper. The use of gas engines to drive works, and their use in the generation of electrical energy for a general supply for lighting and power, were two entirely different things. In the works of an ordinary industrial concern the load was more or less constant, and the engine was started up at, say, 6 a.m. and run until 6 p.m. Even small engines in some works were run on through meal hours owing to the trouble experienced in starting them up. In an electricity supply station the demand increased from, say, 100 H.P. to 700 H.P. in a few minutes, and so the engines were liable to very serious and sudden overloads. One other question; what was to be done with the gas that was not required in the summer months, when the output of electricity was, say, one-third of what it was in the winter, but when the maximum load might approximate the winter load for a few hours, due to fog?

Mr. J. H. Heap, London (communicated), said that the subject was of national importance. They had a ready-made field of industry in the making of pig-iron with the electrical furnace. The few electrical steel furnaces in this country had been, so far more or less, curiosities. On the Continent and in Canada, however, the possibilities of the electrical furnace had been clearly indicated. Data were obtained some years ago to show that any steel above medium Bessemer could be produced more economically in the electric furnace, and they had a special class of alloys of iron of growing consumption which could only be manufactured in the electrical furnace. He thought that 45 per cent. of the gas could be regarded as available after providing for the heating of the blast, running blowing engines and loss:—Heating blast, 38 per cent.; blowing engines, 10 per cent.; loss, 7 per cent.; surplus, 45 per cent. They might reckon on one effective horse-power being obtained with an expenditure of 2,200 calories, say, 4,800 B.TH.U., which had been done some time ago in engines working on producer gas. Regarding the cost of the plant, he thought that £10 per E.H.P. was a high average cost to allow, and as to running costs, from his experience the total energy costs would work out at nearer 35s. than 45s. per E.H.P.

Mr. Dumby said that the public supply of electricity from blast-furnace gas power was by no means an ideal proposal, the average load being only 25 per cent. of the maximum. It was an absolute necessity for the satisfactory utilisation of gas, that the electrical power should be required very nearly throughout the 24 hours, and for seven days a week, in order to get anything like full interest out of the capital expenditure, and that narrowed the field of use very much. A great field would in the future be open to electrical metallurgy. The time for the manufacture of iron or soft steel by the electric furnace was, however, in the distant future.

Mr. Storr pointed out that Mr. Robinson had made no provision for the cost of gas or the amount the gas producers would require for the accommodation given to any utilising company. A distributing company could take sufficient for the minimum load, utilising the gas plant at 100 per cent. load factor, and using coal for the variations of load.

In the course of his reply, Mr. Robinson said Mr. Lackie and others had entirely misunderstood the load factor, though Mr. Storr had got the right idea. He maintained that a corporation or any supply company would be justified in paying a considerable sum to have the call upon that amount of power from gas continuously night and day, including Sundays. As to Mr. Lackie's figures, if slightly under £2 per E.H.P. was for a load factor of 16 per cent., he was certain that, if the plant was run at 100 per cent. load factor, the £2 would be multiplied by three, and the waste gas power could be supplied at under £4. Mr. Lackie had said that all his figures were based upon 10 to 40 per cent. load factors, whereas the bulk of them were for 50 to 65 per cent. The figures he had given could be maintained in practice in large power stations. As to the engine repairs costs, which he had given at 6s. 9d., he pointed out that the cost of engine maintenance was very much reduced. The manufacture of ammonia nitrate was beyond the experimental stage; 19,000 H.P. was now devoted to it, and there was at the present time one station of 140,000 H.P. being erected for this purpose. With reference to Mr. Storr's remarks about the cost of gas, he had provided 10 per cent. profit on the capital cost for the sale of power. This should be regarded as the cash value of the gas used in generating power.

Line Shaft Efficiency, Mechanical and Economic.

An interesting paper under the above heading was read a short time back by Mr. Henry Hesse at the American Society of Mechanical Engineers, and records a series of experiments carried out to determine the comparative efficiency of plain babbitted or cast-iron bearings and ball bearings when used on a workshop line shaft. In his introductory remarks, the author pointed out that in power transmission by line and countershafts, journal friction accounted for more than nine-tenths of the total power lost, belt losses, when proper care is taken, being almost negligible. He further stated that while the coefficient of friction for a plain babbitted or cast-iron bearing might vary from ·005 to ·08, yet ·05 was a good average value, while ·03 was a matter for congratulation. The object of the tests was to determine by how much these values could be reduced by the introduction of ball bearings, and whether the saving so gained would pay for the additional capital expenditure.

As it was but reasonable to expect a certain amount of bias from the makers of the well known Hesse-Bright ball bearings, the actual experiments were carried out by Messrs. Dodge and Day under conditions practically the same as those of a workshop, the sole difference being the substitution of constant loads for the variables of ordinary working.

The shaft used was 72 ft. long, $2\frac{7}{16}$ in. diameter, and supported by 10 bearings (vertical hangers) spaced 8 ft. apart.

The effect of load was obtained by running eight belts off at about equal intervals and driving loose pulleys.

The shafts carrying the loose pulleys were mounted on a swinging frame, the top of which was pivoted to the original machine countershaft, whilst the bottom of the frame could be so pulled by a rope passing over a pulley and carrying an adjustable weight, that any desired tension could be put on the belts, and hence giving the same effect, as far as pull on the main shaft was concerned, as an exactly determinate load.

It might be added that all the countershafts were on one side. The speed of the line shaft was 214 R.P.M., and that of the countershafts from 188 to 343 R.P.M. The bearings compared were plain ring-oiling babbitted boxes and Hesse-Bright ball bearings, facilities being made by which they could be rapidly exchanged. Both types were held by the same supporting screws usual with modern hangers. The shafting was driven by a 10-H.P. motor from the floor, whilst rheostats in the field and a Warner tachometer connected to the motor, enabled the experimenter to maintain constant speed during a run.

The power absorbed was measured by introducing ammeters and voltmeters in the field and armature circuits, and making a careful estimation of the losses in armature, field circuit, &c., when all the necessary data, including no-load losses, were known.

Six duplicate tests on each type of bearing were carried out, the loads being varied from 20 to 90 lb. per in. width of belt.

Each test lasted 40 minutes of running time, a reading of the various instruments being taken every two minutes.

On the plain bearings the load ranged from 5·2 to 27·3 lb. per sq. in. of projected area. In the case of the ball bearings it came out to about 10·5 to 55·2 lb. per ball, each bearing consisting of 12 $\frac{3}{8}$-in. balls.

The power necessary to drive the shaft and countershaft varied from ·072 KW. (ball bearings and all belts off except motor) up to 1·301 KW. (ordinary bearings and 4,977 lb. total resultant pull on shaft line).

The experiments well bore out the great advantage of ball bearings. When running light the gain was as much as 65 per cent., whilst at normal load (belts carrying 44 and 57 lb. per inch width of single belts) the gain was 35 per cent.

The power consumed in plain line and countershafts varies from 10 to nearly 60 per cent. Hence the substitution of ball bearings on the line shaft can result in a saving of from 3·6 per cent. to 21 per cent. of the total power.

A detailed bill of costs for using ball-bearings instead of plain bearings at the end of the paper endeavours to show that the extra saving is equal to 37 per cent. per annum on the capital outlay.

Some Notes on Overhead Line Construction.

(*Discussion on paper by* Mr. W. B. Woodhouse *at the* Institution of Electrical Engineers, *Leeds, February*, 1910.)

Mr. Walter Emmott, in opening the discussion, said the paper would be extremely useful to the members; but local and geographical conditions settled the positions and nature of the supports to such an extent that a line could not be laid out by formula, and the only thing to do was to err on the safe side as to the factor of safety.

Mr. Wilson Hartnell said they might take the calculations as practically correct, and he was much pleased with their simplicity. The diagram which the author gave was an admirable way of embodying a large amount of information, and the very simple method for calculating the combined stresses due to wind and gravity was new to him. In regard to transporting power, they were placed at a great disadvantage in not having the facilities and encouragements that were enjoyed by other countries.

Mr. G. D. Aspinall Parr said that the difficulty with glass insulators had been got over by the Americans by means of a non-alkaline glaze, with the result that the trouble due to leakage had been so much reduced that they could be used not only for high pressures but also in damp atmospheres, while by a special annealing process the glass did not crack or fly. With regard to

the shape of the insulator shown in the paper, the outer shed appeared to be quite useless. It seemed possible for the water to beat completely all round the outside of the inner shed, as well as under the lip and on the outside of the outer shed, so that practically only the interior of the inner shed was effective.

Mr. H. H. Wright said that at Kykkelsrud, about 20 miles from Christiania, the poles were of steel trellis, about 30 ft. high and about 100 yards apart.

Mr. H. E. Yerbury said he had seen the overhead construction in the four countries mentioned in the paper, and thought that the veto possessed by local authorities and the regulations of the Board of Trade were not altogether a curse to this country, for we should hardly tolerate in our cities and towns the class of work frequently seen on the Continent. He was in agreement with the author that less stringent regulations were required for the construction of overhead work on, say, pasture or arable land and country roads, and if the general construction conformed to the physical surroundings, there should be no cause for complaint from an æsthetic standpoint. The question of wayleaves, compulsory or otherwise, had always been a troublesome problem; although the Post Office Telegraph Department might now erect their wires on tramway poles, they in Sheffield charged an annual sum for this concession, because they knew what trouble was caused by falling wires during gales or snowstorms. In manufacturing districts power supply would undoubtedly be cheaper if overhead construction were permitted, and he agreed with the author that a decision in such matters could very well be determined by the Board of Trade. The factor of safety required by the Board of Trade for various wires was, generally speaking, satisfactory, and it was to be regretted that the tensile, torsional and conductivity tests of aluminium compared very unfavourably with copper or bronze wire; but he believed there was a useful field for aluminium, and he purposed experimenting with this for negative return cable work.

Mr. W. B. Woodhouse, in reply, said that, as Mr. Hartnell mentioned, the very serious part of this question was the restrictions that they had to fight against. No doubt some means of obtaining compulsory wayleaves would be very much better for their industry and the country generally. The question of erecting overhead lines through the centre of towns was another thing altogether. A large town should certainly have a right to say whether it would have these wires in the streets, but one found objections from small towns as well. They did not fully appreciate that the introduction of what was termed a hideous set of poles might prevent a still more hideous smoking chimney. His experience of the use of glass insulators had been for switchboard work; they were found to be unsatisfactory. The criticism that Mr. Parr made as to the construction of the insulator illustrated in the paper was quite justified; the drawing was not quite to scale, and actually the top shed was deeper. They had adopted a horn lightning arrester. If one had to take transmission lines a great distance in a practically straight line, no one would hesitate to adopt iron and steel poles. The use of reinforced concrete poles was also spreading; a good deal might be said for them, and one anticipated that their life would be extremely long as compared with steel or wood, but he had had no experience of them.

Physical Society of London.

At the meeting held on February 25th, 1910, a paper on "Telephone Circuits" was read by Prof. J. Perry. The author published a paper in the *Proceedings* of the Society in 1893, showing how the voltage and current were attenuated along a telephone or submarine telegraph line, with resistance, capacity, inductance and leakance. It was pointed out that the introduction of inductance was of great benefit. The author now points out that the capacity may be made negative by the use of inductance leaks to earth, and the inductance may be made negative by the use of condensers in series with the line. The problem is to find how far apart the contrivances may be placed so that the effect produced shall still be beneficial; the object of the author is to give an easy method of calculation which is practically correct and which can be used when the contrivance is any network or other combination of resistances, inductances and capacities—some being leaks to earth—and it may include transformers, motors and generators.

Examples of the use of the method are given, some showing that the detached contrivances produce much the same and others very different effects from what might have been expected from a study of the cable with continuous properties. The author impressed on the audience the fact that his method of calculation could be taught to quite non-mathematical people.

Major O'Meara said that the Post Office had for some time past applied the formulæ, and had obtained a considerable amount of success in doing so, so far as the introduction of loading coils was concerned. When the question of a new cable between England and France was under consideration, he arranged an experiment with some old copper wire weighing 40 lb. per mile covered with 50 lb. of gutta-percha per mile, which had a resistance per loop mile of 44 ohms, and an electrostatic capacity wire to wire of 0·13 microfarad per mile. The gutta percha wire was immersed in a tank, and experiments were conducted on lengths varying from 15 to 105 miles. They made use of some stock coils having an inductance of 83 millihenries, and a resistance of 13·4 ohms at 750 p.p.s., placing the coils at 1½-mile intervals. The attenuation constant was worked out at 0·0427 per mile, and the observed attenuation constant was found to be 0·0419 per mile. From this it was evident that the calculated and observed results practically agreed. For the new submarine telephone cable, they decided that the attenuation constant should be 0·0147 per mile, to be obtained by the insertion of coils one nautical mile apart, having a resistance of slightly less than 6 ohms, and an inductance of 0·100 henry at 750 periods per second. The cable had been manufactured and tested; the actual observed attenuation constant was 0·0140 per mile, so that this again proved the value of the formulæ. The new telephone cable consisted of 160 lb. copper wire, and 300 lb. gutta-percha. It had a conductor resistance per loop mile of 12·5 ohms (excluding the coils) and a wire-to-wire capacity of 0·12 microfarad per mile. In an unloaded state, the attenuation constant of this cable was 0·045 per mile. The question of leakance was certainly of very great importance. It was owing to the very large part that leakance played that their first experiments were not successful. In America telephone engineers had been obliged to abandon the use of glass insulators, and to substitute the highest grade of porcelain insulators to overcome the difficulties which had been met with owing to an insufficient allowance for the part this factor played.

Mr. A. W. Martin said that experimental results showed that improvements of 370 per cent. by coil loading (Pupin method) might be obtained in telephone loops. The 18-ohm per mile cable mentioned in the paper had a measured attenuation constant of 0·045 per mile before loading. After the insertion of certain coils at 3·2-mile intervals, each coil having an inductance of 0·133 henry and offering an effective resistance of 5·4 ohms at 750 p.p.s., the observed attenuation constant per mile was 0·012, which result was fairly in agreement with the value of 0·013 obtained by calculation at 750 p.p.s. When the coils were placed at 2·1-mile intervals, calculation and observation gave the attenuation constant as 0·012 per mile. Coils with cores of properly chosen magnetic material gave a higher inductance for a given effective resistance than air-core coils, and were therefore the better type. Experience showed that the quality of speech transmitted became bad when the number of coils per wave-length at 2,000 p.p.s. was less than 3·14. Continuous loading with fine iron wire produced an improvement of only 60 per cent., where the copper was of 2 sq. mm. area and upwards.

Mr. B. S. Cohen said that he had previously pointed out that an average speech wave consisted of a fundamental varying between 100 and 300 cycles per second, the highest harmonic being about 1,500 and the average of the whole wave 800 cycles. The Fourier series obtained by analysing a number of speech-waves showed that there were a large number of odd and even harmonics of approximately equal importance ranging from the 2nd to the 11th harmonic. This would explain why it was not only useless but absolutely harmful to tune to any particular frequency. There was little doubt that the effect of the combination of inductance and capacity bridges would be satisfactory, as far as commercial transmission was concerned. Since his paper at the St. Louis Congress, Prof. Kennelly's formulæ and methods had been adopted by many telephone engineers.

Dr. Russell said it was exceedingly satisfactory to find that the "loading coils" fulfilled their functions so efficiently and that their performance could be predicted so accurately.

Dr. J. A. Fleming said he happened to be giving a course of post-graduate lectures at University College on the propagation of currents in telephone and telegraph cables. He discussed the formulæ, and said that by the use of artificial loaded lines it was easy to show experimentally the enormous decrease in attenuation caused by properly loading the line.

Mr. G. M. Shepherd, in a letter to the secretary, observed that introducing series capacity brought in a negative inductance which was a function of frequency, so that a composite contrivance of the type indicated by Prof. Perry was likely to be a very fickle aid to telephony, a conclusion fully borne out by practical tests. The insertion of series inductance seemed to be the only natural solution for the telephone problem.

Prof. Perry, in his reply, said that he mentioned the use of a contrivance consisting of condensers in the line and an inductance leak merely to illustrate his paper. What he had endeavoured to do was to show how calculations might be made by non-mathematical people to find the effect of using any contrivance whatsoever.

County of Durham Electrical Power Distribution Co., Ltd.—The directors' report for 1909, to be presented at the meeting on Monday next, states that the total connections to the company's system at the end of the year (including the connections of its Associated Parliamentary Co., the County of Durham Electric Power Supply Co.), amounted to 35,024 H.P., which, compared with the previous year's figures of 29,336 H.P., shows an increase of 5,688 H.P. The profits of the year, together with the balance of £151 brought forward from 1908, amount to £31,263, against which has been charged interest on loans and debenture stock, £12,501, leaving an available balance of £18,762, out of which the directors recommend a dividend of 5 per cent. on the preference shares (interim dividend of 2½ per cent. already paid), £12,500, transferring to depreciation and reserve account £6,000, carrying forward £262. The consumption of electrical energy throughout the area—and, consequently, the revenue of the company—has been adversely affected by the depression in manufacturing business generally, and particularly through the unsettled state of the coal trade. The expenditure on capital account during the year has been £15,166, of which £8,063 represents the outlay on the company's account, and £7,104 the outlay on behalf of the Parliamentary Co., for which this company receives shares.

ELECTRIC TRANSMISSION FROM GENERATING STATIONS WORKED BY BLAST-FURNACE GAS.

His work in connection with a blast-furnace gas installation generating power by furnace gas engines and transmitting it at 16,500 volts to a distance of over 10 miles has led Herr V. Holt to investigate the economic position of such installations as compared with ordinary steam-driven stations.

Considering the case of a 750-KW. installation, he calculates the prime cost of the machinery, whether for a gas station or for a steam station, as practically the same and equal to £19,500. Allowing 15 per cent. on this for interest and sinking fund, the annual charge is £292.

The cost of the overhead line for 1 km. distance is taken as £325, and a 10 per cent. annual charge on this is £32 10s. The cost of the secondary installation, including step-down transformers, switchgear and meters, is £3,000, and an annual charge of 13 per cent. on this is £390.

The two types of installation differ little also in regard to cost of attendance, maintenance, lubricating, &c., and these may be considered as constant, with varying load on the station, provided that the generating station for the high-pressure transmission is considered as only forming part of a large station for supplying the local works.

The heat efficiency of the engines can also be taken as being practically constant at all loads in a large station, even if the transmission load varies between 20 per cent. and 80 per cent. of the maximum. The consumption may be taken as about 3,750 heat units (kg.-calories) per KW.-hour. These 3,750 units in the case of gas engines would be produced by 3·75 cb. metres of gas at 1,000 units per cb. metre. The commercial (minimum) value of this furnace gas is determined by the fact that, if not used for electric generation, it could be used for firing steam boilers for other purposes. The author's experiments have shown that to produce 1 ton of steam in this way at 100 lb. pressure per sq. in., an average of 940 cb. metres of gas having 1,000 kg.-calories per cb. metre are required. This corresponds to a boiler efficiency of about 69 per cent. In the case of an ordinary coal-fired boiler 1 ton of steam would be produced by 134 kg. (300 lb.) of coal having a heat value of 7,000 kg.-calories per kg. Taking the cost of coal as 14s. per ton, the minimum value of 1,000 cb. metres of gas would be

$$\frac{\cdot 134 \times 14 \times 1{,}000}{940} = 2s.,$$

so that the cost of the KW.-hour generated by gas engines may be taken as

$$2 \times 12 \times \frac{3 \cdot 75}{1{,}000} = \cdot 09d.$$

To generate the same energy in an ordinary coal-fed boiler installation would cost about double this, because of the loss in steam mains and the greater cost of maintenance and attendance in connection with the coal furnace as compared with the gas furnace.

There is, therefore, a net difference in cost of production between the furnace gas engine installation and the coal boiler installation of about ·09d. per unit. The smaller the cost of the transmission line, the greater will be the distance to which it is possible to transmit the energy generated by the furnace gas engine before this difference is used up. The losses in the transformer and the line also influence the result. From a curve drawn by the author connecting distance and cost of a unit, he is able to show that, for the conditions assumed, this economical distance, *i.e.*, distance at which the cost of a unit transmitted is the same for both methods of generating, works out as follows:—

Per cent. load factor.	*Distance.*
20	11·2 km.
40	22·4 km.
60	33·6 km.
80	44·8 km.
100	56 km.

For these distances the net cost per effective kilowatt-hour is 1·02d., ·63d., ·54d., ·44d. and ·4d. respectively. Other relations can also be read off the curve. Thus, if the gas station is 30 km. from the consumer, and the steam station 10 km., and if the load factor is 40 per cent., the cost of the power delivered from the gas station will be ·65d., and from the steam station ·67d. If, as would usually be the case, the gas station, owing to its forming part of a large local supply station, can work at a better load factor than the steam station (which would probably have to depend entirely on the distant transmission for its load), the advantage would be in all cases still more in favour of the gas station. The same would be the case if, as often occurs, there is no other local demand for the furnace gases, and they would normally be entirely wasted.

All these variations, and especially variation in cost of line construction, affect the curve, but it remains clear that for transmission distances of 12 to 30 miles, the gas station has the advantage over the coal-driven station, even under the most unfavourable conditions.—*H.E.T.Z.*

Fluxite.—At the Manchester Building Exhibition practical demonstrations are given of the various uses of fluxite soldering paste for tinning and soldering all metals except aluminium, and for jointing lead.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

NEW ZEALAND.—(*Continued.*)

The following goods are admitted free of duty:—Miners' safety lamps and glasses therefor; lamps peculiarly adapted for use on harbour beacons or lighthouses. also appliances peculiar to such lamps; side lights and head lights suited for use on ships; brass, copper and tin in pigs, bars or sheets; insulated cable and wire; carbon in block, sheet or rod; arc lamp carbons; mica, vulcanite and other insulating material; rubber or gutta-percha solutions, insulating tape; electricians' portable testing sets; machine tools; gas engines and oil engines; wheels and tires for railway and tramway passenger cars; mining machinery including electric exploders, fans for mine ventilation, sinking and turbine pumps; electricity meters, being household supply meters; rails for railways and tramways including lay-outs, points and crossings for the same, also fishplates; belting for driving machinery, except of leather; engine packing; india-rubber gloves. The following duties are payable on British goods:—

Leather belting	4d. per lb.
Lamps, not otherwise enumerated, incandescent lampholders, glassware, globes and chimneys for lamps	20% ad val.
Capstan engines for mining shafts, winding engines, driven by electricity, including bed-plates, foundation bolts, and friction clutches when imported with the engines	5% ad val.
Electric generators and electric motors, including slide rails, electric lamps, including globes for arc lamps, electric transformers; also magnetos (not attached to engine) for motor-car, motor-bicycle, motor-vehicle and gas engines... ...	10% ad val.
Rheostats, electric locomotives, and electric desk-fans and motors combined; insulators of china or earthenware; electric batteries and cells; furniture, fittings, instruments, and appliances for the generation, transmission, application, or utilisation of electricity or of electric power of any description whatsoever	20% ad val.

[No person may erect, construct, or establish any station or plant for the purpose of receiving or transmitting communications by wireless telegraphy without first having obtained the consent of the Governor in Council.]

NEW PATENTS APPLIED FOR, 1910.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

4,931. "Improvements in starting apparatus for electric motors." J. A. Hirst and P. S. Brook. February 28th.

4,936. "Improvements in electric clocks." H. B. Swift and W. D. Baxter. February 28th.

4,950 "Improvements in the arrangement of the governing mechanism of electrically or mechanically-driven machines with variable numbers of revolutions." Maschinenfabrik Oerlikon. (Date applied for under Sec. 91 of the Act, June 28th, 1909, being date of application in Germany.) February 28th. (Complete.)

5,004. "Improvements in and relating to attachments for telephones." J. W. Milne. February 28th.

5,014. "Improvements in electric bells." E. I. Parkes. February 28th.

5,034. "Improvements in and relating to the regulation and control of electric currents." S. Z. de Ferranti. February 28th.

5,036. "Improvements in and relating to coin-freed apparatus for use with telephone call boxes and other purposes." P. W. Wall. February 28th.

5,043. "Magneto-electric machine for velocipede lamps and holder therefor." C. Schlick. February 28th. (Complete.)

5,044. "Improvements in and relating to the control of alternating-current electric motors." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) (Date applied for under Rule 13, March 24th, 1909. An invention comprised in Application No. 7,114, dated March 24th, 1909.) February 28th.

5,048. "Insulating conduits for electric wires or conductors." A. P. Hinsky. February 28th. (Complete.)

5,054. "Improvements in protected or armoured electric switch fuses." H. J. Dean. March 1st.

5,063. "Diselectrification of paper." W. Jamieson. March 1st.

5,085. "Improvements in electric switches." M. J. Railing and C. C. Garrard. March 1st.

5,086. "Improvements in alternating-current static transformers for conversion of polyphase currents to single-phase currents." C. L. Roberts. March 1st.

5,092. "Improvements in and relating to electric current collector gear." A. H. Jackson and C. W. Fourniss. March 1st.

5,117. "Improvements in or relating to the ventilation of dynamo-electric machines." Siemens Bros. Dynamo Works, Ltd., E. O. Kiefer and K. W. Schaffer. March 1st.

5,118. "Improvements in or relating to the ventilation of dynamo-electric machines." Siemens Bros. Dynamo Works, Ltd., E. O. Kiefer and M. Kloss. March 1st.

5,119. "Improvements in or relating to the regulation of the speed of polyphase electric motors." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H., Germany.) March 1st. (Complete.)

5,133. "Improvements in electric signalling." R. A. Fessenden. March 1st. (Complete.)

5,172. "Electric alarum watch." W. H. Hill. March 2nd.

5,178. "Improvements in and connected with electrically-driven centrifugal machines." W. A. Macfarlane. March 2nd.

5,186. "Improvements in and relating to automatic liquid starters for controlling the doors of watertight compartments of ships, valves, and the like, electrically." A. Martin and H. Jackson. March 2nd.

5,221. "Improvements relating to electrical switches and the like." D. K. Morris and G. A. Lister. (Application for Patent of Addition to No. 21,988. 1907.) March 2nd.

5,246. "Improved method of resuscitating the negative plates of secondary batteries and assisting in their formation." J. M. Gorham. March 2nd.

5,261. "Improvements in multiple-switch devices for electric motors." Adams Manufacturing Co., Ltd. (Cutler-Hammer Manufacturing Co., United States.) March 2nd. (Complete.)

5,266. "Improvements in electrical induction furnaces." F. J. Brougham. (Poldihutte Tiegelguszsthalfabrik, Austria.) March 2nd. (Complete.)

5,270. "Improvements in multiple-switch devices for electric motors." Adams Manufacturing Co., Ltd. (Cutler-Hammer Manufacturing Co., United States.) March 2nd. (Complete.)

5,289. "Improvements in or relating to incandescent electric lamps." J. A. Scoular, M. Scoular and E. F. Everett. March 2nd.

5,299. "Improvements in electric ignition apparatus for internal-combustion engines." G. Cowcher. March 3rd.

5,313. "Improvements in and relating to electrical indicators for use on trams, trains and the like." F. Harvey. March 3rd.

5,360. "Improvement relating to trolley-wheels for collecting electricity." F. Cuevas, M. R. Cordo and G. Davila. March 3rd.

5,369. "Electroplating apparatus." G. I. Roman. March 3rd. (Complete).

5,374. "Improvements in or relating to telegraphic transmitters." F. G. Creed and W. A. Coulson. March 3rd.

5,383. "Improved devices for connecting telegraph, telephone and other wires or conductors, to their insulators or supports." J. Murdoch. (W. M. Robinson, South Africa.) March 3rd.

5,384. "Improvements in or relating to anti-vibrators for gas burners or electric lamps." H. W. Hanwell. March 3rd. (Complete.)

5,388. "Improvements in processes for manufacturing metal filaments for incandescent electric lamps." A. Lederer and Westinghouse Metal Filament Lamp Co., Ltd. (Application for Patent of addition to No. 6,936/09.) March 3rd.

5,393. "Employment of metals in the electric arc for sterilising liquids." E. Urbain, A. Feige and C. Scal. (Application for Patent of addition to No. 4,796/10.) March 3rd. (Complete.)

5,401. "Improvements in automatic electric switching apparatus." A. J. Howard and A. C. Allen. March 4th.

5,452. "Improvements in or relating to electric arc lamps." Siemens-Schuckertwerke G.m.b.H. (Date applied for under Sec. 91 of the Act, March 9th, 1909, being date of application in Germany.) March 4th. (Complete.

5,465. "Improvements in and relating to switches." A. E. Creese and W. Dederich. March 4th.

5,474. "Improvements relating to electric switches for use particularly on scenic railways." J. H. Iles. March 4th.

5,479. "Improvements in the current commutation of commutator frequency changes." Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke G.m.b.H., Germany.) March 4th. (Complete.)

5,486. "Improvements in the separation and recovery of metals from their ores by means of electrostatic methods." H. L. Sulman and H. F. K. Picard. March 4th.

5,510. "Electric fire and burglar alarm contact." J. Phillips-Woodey. March 5th.

5,553. "Improvements in and relating to wireless telegraphy and telephony." T. M. de Bingham. March 5th.

5,554. "Means and apparatus for duplex wireless telegraphy." T. M. de Bingham. March 5th.

5,555. "Improvements in or relating to radio-telegraphy." T. M. de Bingham. March 5th.

5,561. "Improvements in or relating to arc lamps." T. L. Carbone. March 5th. (Complete.)

5,571. "Improvements in and connected with electric switches." A. H. Midgley and C. A. Vandervell. March 5th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Regulators for Dynamo-Electric Machines. Dick, Kerr & Co. (Thury.) 24,634. November 14th.

1909.

Supply and Regulation of Electrical Energy for Train Lighting and the like. P. L. R. Fraser and Tudor Accumulator Co. 1,820. January 25th.

Electric Arc Electrodes and Process of Making them. British Thomson-Houston Co. (General Electric Co.) 2,027. January 27th.

Electrical Insulating Material. British Thomson-Houston Co. (General Electric Co.) 2,127. January 28th. (Request under Sec. 19 not granted.)

Apparatus for Starting and Controlling Electric Motors, Applicable for Instance to Sewing Machines. H. J. R. Read. 2,383. February 1st.

Plug Fuses and Fuse Boxes for use in Control Systems of Theatrical and like Electric Lights. E. M. M. Johnstone. 2,779. February 5th.

Electrical Heating Apparatus. A. F. Berry. 4,672. February 25th.

Ignition Devices for Internal Combustion Engines. B. Hopps. 5,210. March 3rd.

Bifunctional Storage Battery Plates. A. O. Tate. 9,097. March 24th.

Means for Producing Phase Displaced Electromagnetic Oscillations. M. Monasch. 9,427. April 21st. (Date applied for under International Convention, April 21st, 1908.)

Portable Electric Lamps. H. F. Joel. 9,693. April 23rd. (Application for Patent of Addition to No. 11,106 of 1908.)

Means Employed for Controlling the Speed of Bodies Driven by Alternating-Current Electric Motors. H. A. Mavor and Mavor & Coulson, Ltd. 12,917. June 1st.

Telephonic Transmitters and the like. J. K. Pickford. 14,209. June 17th.

Electrical Mercury Switches Operated by a Vehicle Passing Along a Railway. Siemens Bros. & Co. and L. de M. Ferreira. 15,951. July 7th.

Sound Intensifiers for Telephone Mouthpieces and the like. H. Foss. 17,137. July 22nd.

Electric Dry Batteries. D. Fuller. 17,823. July 31st.

Electric Lighting Devices for Life Buoys. J. F. Trentmann. 19,434. August 24th.

Selector Switch Suitable for the Automatic and Selective Switching of Telephone Lines. J. E. Kingsbury. (Western Electric Co.) 20,841. September 11th.

Electric Switches and the like. T. G. Howe and F. H. Taylor. 22,365. October 1st.

Magneto Ignition Apparatus. R. J. Isaacson. 23,177. October 11th.

Electric Signalling Installations, Particularly for Fire Alarms. Siemens & Halske Akt.-Ges. 24,185. October 21st. (Date applied for under International Convention, October 21st, 1908.)

Telephone Transmitters. M. Moloney and T. Ross. 25,028. October 30th.

Electric Insulators. E. Burton. 25,229. November 2nd.

Carbon Holders in Magneto Ignition Apparatus, Current Distributors or the Like. Firm Robert Bosch. 27,109. November 22nd. (Date applied for under International Convention, July 27th, 1909.)

Electrical Resistances. M. Brüll. 1,998. January 27th. (Date applied for under International Convention, February 1st, 1908.)

Automatic Controlling Switch for Electric Transformers. E. F. Terry, H. S. Peatey and J. Hunt. 2,144. January 29th.

Motors and Transmission Gear for Electrically-Propelled Motor Vehicles. G. W. Mascord, R. Lange and A. Chitty. 2,285. January 30th.

Fuse Switches. A. L. Weekes. 2,287. January 30th.

Contact-Making Devices for Use with the Overhead Trolley Wires of Electric Tramways. R. A. Dawbarn. 2,311. January 30th.

Ignition for Internal-Combustion Engines. S. Griffin. 2,411. February 2nd.

Regulating System for Alternate-Current Installations. A. Heyland. 2,520. February 2nd. (Date applied for under International Convention, February 3rd, 1908.)

Circuit Interrupters to take the place of a Fuse in Electric Lighting and Power Installations. J. E. Spagnoletti. 2,733. February 4th.

Electrical Resistances. A. H. Curtis and Adams Manufacturing Co. 3,191. February 9th.

Manufacture of Filaments or Coherent Conductors of Refractory Material Suitable for Incandescent Electric Lamps and the like. British Thomson-Houston Co. (General Electric Co.) 4,164. February 19th.

Combination Electric Bell-Push and Fire Alarm. R. Hurry. 5,337. March 5th.

Synchronous Alternating-Current Machines with Automatic Regulation of the Tension or Pressure. R. Moser. 7,106. March 24th. (Application for Patent of Addition to No. 6,103, 1909.)

Portable Electrically-Driven Drilling Machines. D. H. de Daillens and A. Joris. 7,410. March 27th.

Electric Lamps or Lanterns. J. M. Muir and C. H. K. Chamen. 9,760. April 24th.

Preparation to be Employed in Making Electrolyte for Primary Batteries. B. E. R. Newlands and R. M. Parkinson. 11,926. May 20th.

Clutches for Electric Automobiles or Automobiles Controlled Electrically. C. M. de Sainte-Claire. 13,234. June 5th. (Date applied for under International Convention, June 27th, 1908.)

Antiseptic Devices for Telephones. E. A. Pickering. 14,012. June 15th.

Third-Rail Electric Railway Systems. C. Kozesnik. 15,032. June 28th.

Electric Ignition Apparatus for Internal-Combustion Engines. L. A. Hindley, H. D. Hindley and W. Stanford. 15,389. July 1st.

Current-Collecting Devices for Dynamo-Electric Machines. British Thomson-Houston Co. and W. F. Dawson. 15,491. July 1st.

Alternating-Current Dynamo-Electric Machines. L. J. Hunt and Sandycroft Foundry Co. 16,170. July 10th.

Production of Compounds of Oxygen and Nitrogen by Electrical Means. P. Bunet and A. Badin. 16,224. July 12th. (Date applied for under International Convention, August 17th, 1908.)

Control of Dynamo-Electric Machinery in Electric Lighting Installations Worked with Accumulators. Akt.-Ges. Brown, Boveri et Cie. 16,631. July 16th. (Date applied for under International Convention, September 14th, 1908.)

Magnetic Compasses. Kelvin & James White, Ltd., L. W. P. Chetwynd and F. W. Clark. 19,057. August 19th.

Fusible Cut-Outs for Electrical Apparatus. A. E. Edwards. (J. W. German.) 19,268. August 21st.

Carbons for Electric Arc Lamps. K. Weinert. 20,832. September 11th.

Method of and Means for Charging Electrical Accumulators for Secondary Batteries. J. Schmeltz. 23,863. October 18th.

Influence Machines. G. Harrison. (B. E. Baker.) 25,106. November 1st.

Magnetic Compasses. Kelvin & James White, Ltd., L. W. P. Chetwynd and F. W. Clark. 29,719. December 30th. (Date applied for under Rule 13, August 19th, 1909.)

Switch for Electric Currents. J. J. Rawlings. 373. January 7th.

Controllers for Electric Motors. R. F. Baerlocker. 2,715. February 4th.

Manufacture and Arrangement of the Electrodes of Secondary Batteries (Accumulators). H. Garde and A. J. Adams. 2,749. February 4th. (Date applied for under International Convention, April 2nd, 1908.)

Switches for Electrical Purposes. T. J. Rorke and E. Rorke. 2,754. February 4th.

Uni-Polar Turbo-Dynamo with the Blade Wheels Running in Opposite Directions. R. Schulz. 2,755. February 4th.

Electrical Controllers. J. G. Thomas. 2,943. February 6th.

Alternating Electric Current Distribution Systems. J. S. Peck, K. M. Fayne-Hansen and S. Lusgarten. 3,046. February 8th.

Switches and Adapters for Controlling Lamps. Simplex Conduits, Ltd., and W. T. Elliott. 3,105. February 9th.

Automatic Electric Switches, Electricity Meters, and Similar Apparatus where Operating or Controlling Coils are in Circuit whilst the apparatus is in use. F. C. Dannatt. 3,176. February 9th. (Cognate application, 18,268, 1909.)

Draught, Dust and Weather Excluder, with Electric Bell Alarm. E. Spencer. 3,249. February 10th.

Arc Lamps. A. Holman. 3,371. February 11th. (Application for Patent of Addition to No. 27,586, 1908.)

Control Systems for Electric Motors. J. S. Peck. 3,533. February 22nd.

Electric Radiators and other Apparatus where Banks of Massed Lamps or other Radiating Devices are used. W. Fennell and W. P. Perry. 3,554. February 23rd.

Locking Devices for Holders for Electric Glow Lamps and other Objects. G. Bowron. 3,674. February 25th.

Electric Clocks and like Instruments. H. Creese. 3,851. February 16th.

Electric Winding Devices more Particularly for use with Time Switches, Meters and the like. H. F. Reason and Reason Manufacturing Co. 3,854. February 16th.

Textile Fabrics Having Electrical and other Properties. H. P. Pearson. 4,677. February 25th.

Rotors of Alternating-Current Dynamo-Electric Machines, Especially Applicable to Induction Motors. Lancashire Dynamo and Motor Co. and A. R. Stelling. 6,477. March 18th.

Processes for Manufacturing Metal-Filaments for Incandescent Electric Lamps. Westinghouse Metal-Filament Lamp Co. (A. Lederer, Austria.) 6,936. March 23rd.

Electric Lampholders. J. Sedgwick. 8,077. April 5th.

Electric Incandescent Lamp Making Machines. British Thomson-Houston Co. (Gen. Elec. Co.) 8,351. April 6th.